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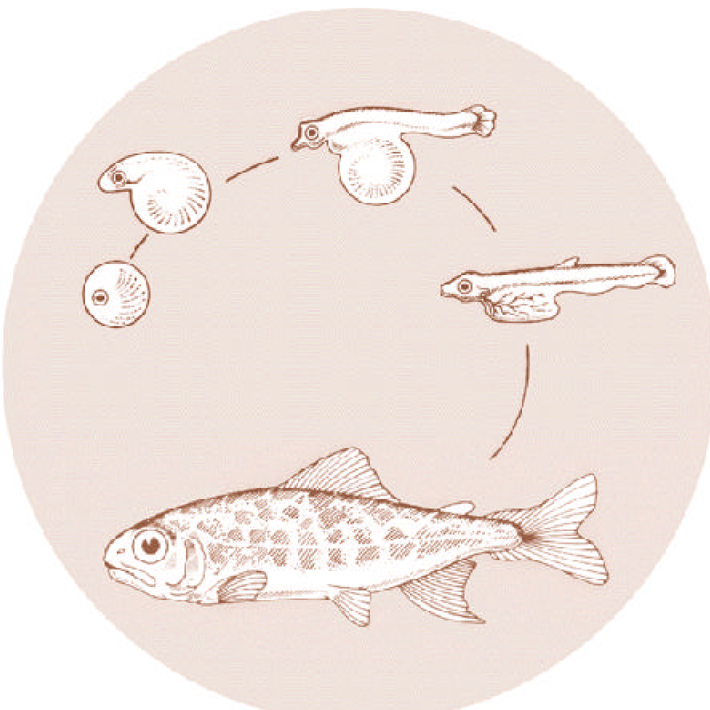
A COMPREHENSIVE PLAN FOR REHABILITATION OF ANADROMOUS FISH STOCKS IN THE UMATILLA RIVER BASIN

Final Report 1985



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FINAL REPORT

A Comprehensive Plan for Rehabilitation of Anadromous Fish Stocks in the Umatilla River Basin

by

Oregon Department of Fish and Wildlife

Project Leader: Raymond R. Boyce

Cooperating Agencies

Confederated Tribes of the Umatilla Indian Reservation;
Fish and Wildlife Service,
U. S. Department of the Interior;
National Marine Fisheries Service,
U. S. Department of Commerce;
Bureau of Reclamation,
U. S. Department of the Interior;
Forest Service,
U. S. Department of Agriculture

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Executive Summary

A comprehensive plan for rehabilitation of anadromous fish stocks in the Umatilla River Basin was developed by the Oregon Department of Fish and Wildlife (ODFW) in cooperation with the Confederated Tribes of the Umatilla Indian Reservation, the National Marine Fisheries Service, the Fish and Wildlife Service, the Bureau of Reclamation, and the Forest Service. This effort supplements the 5-year Rehabilitation Plan developed by the Tribes and ODFW in 1984. Funds were provided by the Bonneville Power Administration (BPA) (Project No. 84-10). The primary goals of the planning effort were threefold:

Goal 1 Establish fishery rehabilitation objectives for naturally and hatchery produced salmonids in the Umatilla Basin.

Goal 2 Estimate potential benefits of each of the rehabilitation and flow enhancement projects to naturally and hatchery produced salmonids.

Goal 3 Develop a plan to set priorities, implement, and evaluate projects that will achieve rehabilitation objectives (Goal 1 above).

Anadromous Fishery Resources

The Umatilla River presently supports a small run of native summer steelhead. Counts of adults at Three Mile Falls Dam during 1966/67-1982/83 averaged 1,861.

Historically, the Umatilla River supported runs of fall and spring chinook and coho salmon before overfishing, extensive water use, habitat degradation, and Columbia River hydroelectric projects eliminated runs.

Hatchery Supplementation and Reintroduction Efforts

Sumner steelhead were released into the Umatilla during 1967-69 and since 1981 (up to 60,500 yearlings and 67,980 subyearlings have been released annually since 1981). Releases of fall chinook into the basin include 3.83 million tule stock subyearlings in 1982, 100,000 and 223,632 upper river bright yearlings in 1983 and 1984, respectively, and 637,190 upper river bright subyearlings in 1984. Spring chinook have yet to be reintroduced into the basin although the first release of spring chinook (Carson stock) will be made in 1986. Coho were introduced in the basin in 1966 (500,000 subyearlings), 1967 (200,000 subyearlings and 500,000 eggs), 1968 (750,000 eggs), and 1969 (200,040 yearlings) although these introductions did not result in reestablishment of runs.

Factors Limiting Anadromous Fish Production and Needs

Stream Flow and Temperature

Low stream flow is the chief factor limiting production of anadromous salmonids within the Umatilla Basin. Summer flows are extremely low due to naturally low stream flow and numerous irrigation diversions in the lower river. Water withdrawals during summer and fall months often cause dewatering of some reaches in the main stem which eliminates rearing area. Water temperatures in the lower main stem typically exceed 80' F which is above upper lethal temperatures of anadromous salmonids.

Low stream flows can hinder upstream passage of adults. Umatilla flows are generally inadequate (<250 cfs) before November for passage of summer steelhead and fall chinook and in June for passage of spring chinook (when reintroduced). Low stream flows can also inhibit downstream passage of juveniles. During years of low runoff, most flow during April-June is diverted for irrigation or stored in reservoirs. When these low flow conditions occur (approximately 1 in 10 years), all steelhead smolts (up to 110,000/year) are trapped at Westland and hauled to the Columbia River. Without trucking, it is estimated that survival of wild and hatchery juveniles in the lower Umatilla under present flow conditions would average 86-90% for summer steelhead, 70-90% for fall chinook, and 90% for spring chinook. It is likely that in low flow years, survival of migrating smolts would be considerably less than average.

Restricted Adult Passage at Diversion Dams and Below Three Mile Falls Dam

Five Umatilla River diversion dams (Three Mile Falls, Westland, Stanfield, Maxwell, and Cold Springs) limit upstream fish migration. Three Mile Falls Dam (RM 3.0) is the highest diversion dam on the Umatilla (24 ft crest height) and is a formidable obstacle to upstream passage of adults. At high flows (>500 cfs), a high percentage of water spills over the crest of the dam and causes a false attraction problem for steelhead and chinook in the tailrace area. An estimated 20% of the 1982-83 steelhead run was lost to entrapment beneath the dam.

The channel between Three Mile Falls Dam and the mouth of the Umatilla has bedrock flats, is generally undefined, and has dead end channels and shallow pools which inhibit upstream passage of adults. In the past, biologists have observed that the channel was a complete barrier to summer steelhead at flows less than 200 cfs. The Corps contracted with BPA as part of the Fish and Wildlife Program to improve upstream passage conditions for adult steelhead and chinook. Major channel work was completed in 1984 and all channel work will be completed in 1986.

Channel areas between Maxwell (RM 14.8) and Westland (RM 27.3) Diversion Dams are especially limiting to the upstream passage of fall chinook due to extremely low flows during fall months. No passage improvements have been proposed because there is no practical means to improve passage in these areas.

Fish Screening at Irrigation Diversions

The Umatilla Basin has an extensive network of screened and unscreened diversions located on the main stem Umatilla and on Birch Creek and tributaries that present passage problems to downstream migrants. Screen mesh openings and approach velocities at screened diversions exceed criteria established by the fish and wildlife agencies at most of the major irrigation diversions in the lower 32 miles (West Extension, Maxwell, Westland, Cold Springs and Stanfield). Few juvenile fall chinook would survive and losses of steelhead and spring chinook smolts would be severe at the excessive approach velocities at Westland (up to 2.44 ft/sec). Additionally, approximately 50% of fall chinook juveniles would pass through the 1/4" screen mesh opening at Westland and about 25% would pass through the 5/32-3/16" screen openings at Cold Springs and Maxwell.

There are 16 small ditches on the Umatilla River and Birch Creek that lack fish screens. Generally, less than 5 cfs are diverted at each of these ditches.

Survival of hatchery and wild juveniles over all screened and unscreened diversions under existing flows is estimated to be 79-86% for summer steelhead, 23-78% for fall chinook, and 77-80% for spring chinook.

Riparian and Instream Habitat

The loss of riparian habitat and lack of pools and instream structures contribute to poor stream conditions which limit fish production in the basin.

Approximately 70% of the 422 stream miles inventoried on the Umatilla need riparian rehabilitation (FWS and NMFS 1982).

Future Hydropower Development

There are three proposed hydropower projects which could negatively impact the basin's fishery resources. The first two (Three Mile Falls and McKay Dam Projects) are at existing structures and the third (Boyd Project) is a new diversion. The Boyd Project would be the largest diversion (up to 500 cfs) in the basin. Development of fish protection facilities has been coordinated with the fish and wildlife agencies. The project is under construction.

Present and Proposed Flow Enhancement and Fishery Rehabilitation Projects and costs

A listing of present and proposed flow enhancement and fishery rehabilitation projects is presented in Table i. Flow enhancement projects that were evaluated include the Bureau of Reclamation's Columbia River Pumping (CRP) and CRP/Meacham Dam Plans and the McKay Storage Plan. Fishery rehabilitation projects that were evaluated include upstream and downstream passage improvements at diversion dams and canals and in the channel below Three Mile Falls Dam, adult and smolt trapping/trucking projects, and habitat improvements in important headwater streams.

Several of the projects have been completed or initiated. Hatchery reared bright fall chinook were reintroduced for broodstock development. Bonifer and Minthorn Springs adult collection/juvenile release facilities were

Table i. Present and proposed flow enhancement and fishery rehabilitation projects in the Umatilla Basin.

Flow Enhancement Projects

Long Term Projects

1. Columbia River Pumping Plan
2. Columbia River Pumping/Meacham Dam Plan

Interim Project

1. McKay Storage Plan

Fishery Rehabilitation Projects

Long Term Projects

Upstream Passage Improvement

1. Lower Umatilla River channel modification
2. Three Mile Falls, Westland, Stanfield, Cold Springs, and Maxwell diversion dams.

Downstream Passage Improvement

1. West Extension, Westland, Stanfield, Cold Springs, Maxwell, Brownell and Dillon screen replacement.
2. Umatilla River and Birch Creek screen replacement/installation.

Habitat Improvement

1. Meacham, North Fork Meacham, Thomas, Squaw, Birch, East Fork Birch, West Fork Birch, Buckaroo, and Ryan creeks and North and South Fork and main stem Umatilla River instream rehabilitation.
2. Meacham, North Fork Meacham, Squaw, Birch, East Fork Birch, West Fork Birch, Buckaroo, and Ryan creeks and South Fork and main stem Umatilla River riparian protection/rehabilitation.

Hatchery Production

1. Hatchery facility for 200K summer steelhead.
2. Bonifer and Minthorn Springs adult collection/juvenile release facilities.
3. Fall and spring chinook and coho production.

Interim Project

Adult and Smolt Trapping/Trucking

1. Westland smolt trapping facility expansion.
2. Adult and smolt trucking program expansion.

constructed in 1983 and 1985, respectively. Major work was completed in 1984 on the lower channel and all work will be completed in 1986. Habitat improvements in Squaw Creek and at Minthorn Springs were completed in 1984. Site investigations were completed in early 1985 for the Umatilla River Summer Steelhead Hatchery and a committee was formed to develop final design. And, the environmental assessment for passage improvements at Three Mile Falls Dam was completed late in 1985.

Preliminary total construction/capital and annual operation/maintenance costs of fishery rehabilitation projects (not including flow enhancement) are $10,623,450 and $227,032, respectively (Table ii). Preliminary costs for the CRP Plan are $33,234,000 and $253,900 for construction/capital and operation/maintenance, respectively, and $125,461,000 and $218,6001/ for the CRP/Meacham Dam Plan. Operation/maintenance costs for both projects do not include undefined pumping power costs. Operation/maintenance costs of the fishery rehabilitation projects would be reduced by $17,409 by the Bureau's flow enhancement projects. This savings would result from reduced hauling of adults and smolts.

Approximately $1.67 million has been spent on salmon and steelhead restoration in the Umatilla since 1980.

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a/ With completion of Meacham Dam, the West Extension Irrigation District pump would no longer be required and annual operating cost would be reduced to $218,600.

Table ii. Preliminary cost estimates for flow enhancement and fishery rehabilitation projects proposed in the Umatilla Basin. Costs are not included for projects which have been completed or the Umatilla Summer Steelhead Hatchery and the McKay Storage Plan project.

Flow Enhancement Projects (1983 prices)	Construction/Capital costs (dollars)	Annual Operation/ Maintenance Costs (dollars)
Columbia River Pumping Plan	33,234,000	253,900[a/]
Columbia River Pumping/ Meacham Dam Plan	125,461,000	218,600[a/]
Fishery Rehabilitation Projects		
Upstream Passage Improvement (1984 and 1985 prices)		
Three Mile Falls Diversion Dam	1,680,000	50,000
Westland Diversion Dam	216,000	2,000
Stanfield Diversion Dam	75,000	1,000
Cold Springs Diversion Dam	24,000	1,000
Maxwell Diversion Dam	24,000	1,000
TOTAL	2,019,000	55,000
Downstream Passage Improvement (1984 and 1985 prices) Large Diversions		
West Extension Screen	1,830,000	22,000
Westland Screen	1,000,000	20,000
Stanfield Screen	670,000	10,600
Cold Springs Screen	1,000,000	25,000
Maxwell Screen	420,000	7,400
TOTAL	4,920,000	85,000
Small Diversions (1984 prices)		
Brownell Screen	3,500	130
Dillon Screen	4,600	130
Umatilla River and Birch Creek Unscreened Diversions (16 diversions)	47,600	2,080
TOTAL	55,700	2,340

Table ii. (Cont.)

	Construction/Capital costs (dollars)	Annual Operation/ Maintenance Costs (dollars)
Adult and Smolt Trapping/Trucking (1984 prices)		
2,500 gallon fish truck	130,000	14,100 (11,844)[b/]
365 gallon tank, trailer, and truck	22,000	2,400 (1,248)
Westland Smolt Trap Expansion	53,500	2,000 (2,000)
Power Crowder	50,000	5,000 (5,000)
Fish Pump	15,000	1,500 (1,500)
Labor (EBA-1)		21,002 (7,001)
TOTAL	270,500	46,002 (28,593)
Habitat Improvement (1983 prices)		
Meacham Creek and N. Fork Meacham Creek	426,750	3,800
N. and S. Fork Umatilla River	327,000	6,680
Thomas Creek	160,000	4,000
Mainstem Umatilla River (Meacham Cr. to Forks)	250,000	2,200
Squaw Creek	238,000	2,000
Birch Creek	346,000	3,400
E. and W. Fork Birch Cr.	724,000	8,600
Buckaroo Creek	126,000	1,200
Ryan Creek	165,500	2,210
Mainstem Umatilla River (Pendleton to Meacham Cr.)	595,000	4,600
TOTAL	3,358,250	38,690
FISHERY REHABILITATION PROJECTS GRAND TOTAL[b/]	10,623,450	227,032

a/ Does not include pumping power costs

b/ Costs with enhanced flows of the CRP or CRP/Meacham Dam Plans

c/ Does not include cost of the Umatilla Summer Steelhead Hatchery

Rehabilitation Objectives and Potential Fishery Benefits

Natural Production

Natural production capacities (in terms of adult returns required for maximum smolt production) for the basin under existing flows are 1,881 summer steelhead, 11,097 fall chinook, and 582 spring chinook (Table iii). Production capacities are approximately similar under the CRP and McKay Storage Plans. Production capacities of summer steelhead and spring chinook would be greater under the CRP/Meacham Dam Plan (2,859 summer steelhead and 1,166 spring chinook) due to increased smolt production from augmented summer flows by Meacham Dam.

Table iii. Number of adult spawners necessary to seed available habitat for maximum smolt production of anadromous salmonids in the Umatilla River.

	Existing flows	Enhanced flows: Long Term Projects[a]		Enhanced flows: Interim Project[b]
		CRP Plan	CRP/Meacham Dam Plan	McKay Storage Plan
Summer steelhead[c]	1,881	1,881	2,859	1,881
Fall Chinook	11,097	10,890	11,403	11,097
Spring chinook	582	582	1,166	582

a Projects are potential long term solutions to the basin's fishery problems.
b Project would be used as an interim measure to enhance flows until the CRP or CRP/Meacham Dam Plans are implemented.
c Production figures were averaged from two estimates.

To estimate benefits of rehabilitation projects, we used a general life history model for naturally produced fish. Since the projects will affect various life stages, benefits were evaluated over one life cycle. Assuming production capacities are achieved, we estimated the potential fishery benefits that would result in a single life cycle. Because "available habitat" for anadromous species will vary with flow conditions, we estimated capacities based on existing flows and each enhanced flow. The specific methods used to generate estimates of natural production necessary to seed available habitat and fishery benefits are described in detail in Appendices C and D.

Under each of the flows, accomplishment of all projects would provide substantial fishery benefits to naturally produced fish in the basin. Under existing flows, we could achieve ultimate[a/] returns of 2,965 summer steelhead, 5,204 fall chinook, and 603 spring chinook if upstream and downstream passage and habitat improvement projects are completed and adults and smolts are trucked when necessary (Table iv). If no projects are implemented, only 682 summer steelhead, 3 fall chinook, and 41 spring chinook would be produced.

Potential fishery benefits of the rehabilitation projects are greatest under tne CRP/Meacham Dam Plan. Ultimately, 5,229 summer steelhead, 11,920 fall chinook, and 2,460 spring chinook could be produced. The reasons for the greater production of fall chinook at the higher flows are threefold:

1) There would be no loss in production due to delay in migration of adults. With existing low flows in the fall, we estimated a 25% loss in production from spawning of adults before reaching upper Umatilla River spawning areas and increased mortality due to the delay.

2) There would be a 36.2% increase in survival of adults over upstream passage obstructions.

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a/ Ultimate production is defined as returns following completion of all rehabilitation projects.

Table iv. Natural production fishery benefits[c]/ (in terms of adult returns to the mouth of the Umatilla River)[d]/ from fish rehabilitation projects in the Umatilla River.

Projects	Existing Flows			Enhanced Flows: Long Term Projects[a]/ — CRP Plan			Enhanced Flows: Long Term Projects[a]/ — CRP/Meacham Dam Plan			Enhanced Flows: Interim Project[b]/ — McKay Storage Plan		
	StS	ChF	ChS	StS	ChF	ChS	StS	ChF	ChS	StS	ChF	ChS
1. No action	682	3	41	1,169	956	214	1,869	2,764	667	682	7	41
Passage and Habitat Projects												
2. Upstream Passage Improvement Only	1,115	222	152	1,505	2,368	437	2,336	3,846	1,042	1,115	319	152
3. Downstream Passage Improvement Only	867	12	51	1,469	3,751	268	2,327	7,831	815	867	31	51
4. Habitat Improvement Only[f]/	1,228	3	74	2,105	956	385	3,364	2,764	1,201	1,228	7	74
5. Upstream and Downstream Passage Improvement	1,416	973	190	1,891	9,285	546	2,905	10,896	1,274	1,416	1,401	190
6. Upstream and Downstream Passage and Habitat Improvement	2,550	973	342	3,404	9,285	983	5,229	10,896	2,294	2,550	1,401	342
Trucking Projects[e]/												
7. Adult and Smolt Trucking Only	793	1,117	204	1,169	2,630	387	1,869	3,953	822	793	1,326	204
All Projects Implemented												
8. Passage, habitat and trucking[e]/ Projects	2,965	5,204	603	3,404	11,217	1,162	5,229	11,920	2,460	2,965	6,241	603

a/ b/ See footnotes in Table iii.

c/ Does not include benefits to ocean and Columbia River fisheries which would be substantial. In addition, does not include "non-production" benefits from both the CRP and CRP/Meacham Dam Plans: 1) Tribes treaty reserved right to salmon and steelhead would be achieved; 2) Conflict involving stream flows between Indians and non-Indians would be resolve; 3) Optons for Indian and non-Indian harvest and management would be increased; 4) Value (percentage of fish in "bright" condition) of fall chinook entering the Umatilla would be increased; and 5) Need for trucking would be reduced (see text for additional explanation).

d/ For purposes of the model, we assumed no harvest in the Umatilla River.

e/ Project would be used as interim measure to restore passage until the CRP or CRP/Meacham Dam Plans are implemented.

f/ [illegible] Creek only.

3) There would be a 3.0% increase in survival of juveniles in the lower stream channel.

The greater production of summer steelhead and spring chinook under the CRP/Meacham Dam Plan would result from increased survival of adults over upstream passage obstructions and increased production of smolts due to increased summer flows from Meacham Dam.

Fishery benefits would be somewhat less under the CRP than the CRP/Meacham Dam Plan. Ultimately, 3,404 summer steelhead, 11,217 fall chinook, and 1,162 spring chinook could be produced under the CRP. The slightly lower production of fall chinook under the CRP than the CRP/Meacham Dam Plan would be caused by a 1% lower survival of adults over upstream passage obstructions and reduced spawning potential (10,890 versus 11,403) at the lower flows during fall months. Production of summer steelhead and spring chinook would be less under the CRP than the CRP/Meacham Dam Plan since stream productivity would not be increased.

Only under the enhanced flows would returns of all naturally produced species be sufficient for full seeding of natural habitat and support of in-river fisheries. However, because of poor survival in their upstream migration, escapements of fall chinook will be below full seeding under existing and McKay Storage Plan flows. Even if all rehabilitation projects were completed, production capacities could not be met under existing flows or those provided by the McKay Storage Plan.

Our assessment of rehabilitation projects does not include benefits to ocean and Columbia River fisheries which would be substantial. The number of fall and spring chinook harvested in ocean and Columbia River fisheries can be estimated by multiplying returns to the Umatilla (Table iv) by 3 and 1, respectively. Harvest of summer steelhead in Columbia River fisheries can be estimated by multiplying returns by 1.5.

These would be several additional benefits from both the CRP and CRP/Meacham Dam Plans:

1) Tribes treaty reserved right to salmon and steelhead would be achieved.

2) Conflict involving stream flows between Indians and non-Indians would be substantially reduced.

3) Options for Indian and non-Indian harvest and management in the lower Umatilla would be increased.

4) Value of fall chinook entering the Umatilla would be increased.

5) Need for a costly and logistically difficult trucking program would be reduced.

Fishery benefits would be slightly greater under the McKay Storage Plan than under existing flows, increasing returns of fall chinook to 6,241. Since the McKay Storage Plan is designed to improve upstream passage of fall chinook, there would be no additional fishery benefits to summer steelhead and spring chinook.

Under each of the flows, accomplishment of all rehabilitation projects is necessary to achieve maximum fishery benefits of the rehabilitation plan. Fishery benefits would be minimal if selected individual projects were completed; however, because survival of fish over the series of dams, screens, and instream obstructions are multiplicative, fishery benefits are greatly increased as all projects are completed.

Upstream and downstream passage improvements would provide greatest benefits to fall chinook, whereas habitat improvements would yield greatest benefits to summer steelhead and spring chinook. Our evaluation of fishery benefits from habitat improvements was limited to Meacham Creek. We predicted a 3.0-fold increase in number of summer steelhead and spring chinook smolts from proposed habitat improvements in Meacham Creek.

Hatchery Production

Hatchery production rehabilitation objectives (5,400 summer steelhead and 10,000 each fall and spring chinook) were established by the Confederated Tribes of the Umatilla Indian Reservation and the Oregon Department of Fish and Wildlife. Releases required to achieve objectives are listed in Table v.

Table v. Hatchery production objectives (in terms of adult returns to Bonifer and Minthorn Springs adult collection/juvenile release facilities) and required releases for anadromous salmonids in the Umatilla River.

	Adults	Releases required to achieve objectives	
		Smolts	Fingerlings
Summer Steelhead	5,400	200,000[a]	--
Fall Chinook	10,000	225,000[b]	2,958,350[c]
Spring Chinook	10,000	1,666,667[d]	--

[a] Assuming a 2.7% survival rate.
[b] Assuming a 0.5% survival rate.
[c] Assuming a 0.3% survival rate.
[d] Assuming a 0.6% survival rate.

Similar to natural production, we used a general life history model to determine benefits of rehabilitation projects to hatchery production. We used production objectives as a starting point and estimated benefits that would result in a single life cycle. Methods to determine rehabilitation objectives of hatchery production and fishery benefits are fully described in Appendices C and D.

Under existing flows, we could achieve ultimate returns of 4,379 summer steelhead, 4,495 fall chinook, and 4,797 spring chinook if upstream and downstream passage improvements are completed and adults and smolts are trucked when necessary (Table vi). If no action is taken, only 2,080 summer steelhead, 3 fall chinook, and 565 spring chinook would be produced.

Similar to natural production, hatchery fish benefits of the rehabilitation projects would be greatest under the enhanced flows of the CRP/Meacham Dam Plan: 5,081 summer steelhead, 9,955 fall chinook, and 9,765 spring chinook.

Table vi. Hatchery production fishery benefits[c] (in terms of adult returns to Bonifer and Minthorn Springs adult collection juvenile release facilities)[d] from fish rehabilitation projects in the Umatilla River.

Projects	Existing Flows			Enhanced Flows: Long Term Projects[a] — CRP Plan			Enhanced Flows: Long Term Projects[a] — CRP/Meacham Dam Plan			Enhanced Flows: Interim Project[b] — McKay Storage Plan		
	StS	ChF	ChS	StS	ChF	ChS	StS	ChF	ChS	StS	ChF	ChS
1. No action	2,080	3	565	3,369	1,206	3,011	3,509	3,414	4,819	2,080	9	565
Passage and Habitat Projects												
2. Upstream Passage Improvement Only	3,401	287	2,116	4,338	2,986	6,130	4,385	4,778	7,535	3,401	413	2,116
3. Downstream Passage Improvement Only	2,411	12	729	3,904	3,280	3,840	4,066	6,540	5,820	2,411	28	729
4. Upstream and Downstream Passage Improvement	3,941	893	2,727	5,027	8,121	7,820	5,081	9,100	9,110	3,941	1,345	2,727
Trucking Projects[e]												
5. Adult and Smolt Trucking Only	2,311	1,312	2,833	3,369	3,313	5,439	3,509	4,882	5,944	2,311	1,560	2,833
All Projects implemented												
6. Passage and trucking[e] projects	4,379 (5,400)[f]	4,495 (9,823)[f]	4,797 (10,000)[f]	5,027 (5,400)[f]	9,810 (10,000)[f]	9,235 (10,000)[f]	5,081 (5,400)[f]	9,955 (10,000)[f]	9,765 (10,000)[f]	4,379 (5,400)[f]	5,389 (9,823)[f]	4,797 (10,000)[f]

a b c d e See footnotes in Table iv.

f Returns to the mouth of the Umatilla before in-river harvest and mortality associated with upstream passage problems.

This greater return to the collection facilities would result solely from an increased number of adults entering the river (i.e., there would be no loss in production due to delay in migration) and improved survival of adults over upstream passage obstructions.

Ultimate production of fall and spring chinook would be slightly lower under the CRP than the CRP/Meacham Dam Plan due to slightly lower survival of adults over upstream passage obstructions.

The McKay Storage Plan would provide slightly greater fishery benefits than under existing flows, increasing returns of fall chinook to 5,389. There would De no additional fishery benefits to summer steelhead and fall chinook.

At peak production, the number of surplus hatchery adults (adults in addition to those needed for hatchery production) which could be harvested or used for supplementation of natural stocks would be greater under enhanced flows (4926-4980 steelhead, 7885-8030 fall chinook, and 9099-9629 spring chinook) than existing or McKay Storage flows (4278 steelhead, 2570-3464 fall chinook, and 4661 spring chinook).

Similar catch to escapement ratios used for naturally produced fish can be used to estimate contribution of hatchery adults to ocean and Columbia River fisheries.

Proposed Rehabilitation Plan

Priorities and Schedules for Implementation

The proposed plan for rehabilitation of anadromous salmonids in the Umatilla Basin is presented in Table vii. The table suggests priorities and implementation schedules for fishery rehabilitation and flow enhancement projects over five fiscal years (in terms of years to complete, subsequent to initial start-up of the Rehabilitation Plan). The proposed rehabilitation and flow enhancement projects are listed separately. Although the rehabilitation projects are listed in order of priority, all nine projects plus the flow enhancement proposals must be completed to achieve maximum (ultimate) fishery benefits listed in Tables iv and vi. To assure of achieving greatest benefits in a cost effective manner, continuous exchange between plan implementors and decision makers must occur. As decisions are made, projects are completed, and as biological, social, or political issues are identified, the plan will be updated and amended.

The Bureau's flow enhancement projects received top priority because 1) natural escapement objectives for all species would be achieved on a sustained basis (with completion of proposed rehabilitation projects), 2) the Tribes fishing rights would be realized, 3) conflict involving stream flows between Indians and non-Indians would be resolved, thus eliminating risk of litigation, 4) options for harvest and management in the lower Umatilla River would be increased, 5) value of fall chinook entering the Umatilla would be increased, and 6) need for a costly and logistically difficult trucking program would be reduced.

Table vii. Umatilla River fishery rehabilitation plan -- priorities and schedules for implementation.

FW Program Reference	Project	Implementation Schedule Years to Complete a/ 1	2	3	4	5
	Flow Enhancement Projects					
704(d)(2)	1. McKay Storage Plan	0				
	2. Bureau of Reclamation's CRP or CRP/Meacham Dam Plans	+	+	+	+	0
	Fishery Rehabilitation Projects					
704(i)(l)	1. Hatchery facility for 200K summer steelhead	+	0			
	2. Fall and spring chinook and coho hatchery production	+	+	+	+	0
704(d)(l) Table 2	3. Three Mile Falls upstream and downstream passage improvement	+	+	0		
	4. Adult and smolt trapping/trucking program		+	0		
	5. Westland upstream and downstream passage improvement and smolt trapping facility		+	0		
	6. Cold Springs upstream and downstream passage improvement			+	0	
	7. Maxwell and Stanfield upstream and downstream passage improvement				+	0
	8. Small diversions downstream passage improvement					
	a. Brownell and Dillon	+	0			
	b. Umatilla River unscreened diversions (5)		+	0		
	c. Birch Creek unscreened diversions (11)			+	0	
	9. Habitat improvement					
	a. Meacham and North Fork Meacham Creeks		+	+	0	
	b. North and South Fork Umatilla River Thomas Creek	+	+	0		
	c. Mainstem Umatilla River (Meacham Creek to Forks)		+	+	0	
	d. Squaw Creek			+	0	
	e. Birch and East and West Fork Birch Creeks			+	+	0

[a]/ Subsequent to initial start-up of the rehabilitation plan.
± Project initiation
0 Project completion

It will take several years of intensive hatchery reintroduction and supplementation effort to achieve natural and hatchery production goals due to lack of salmon and severe depletion of steelhead in the basin, so hatchery production projects received high priority. The Rehabilitation Plan identifies the escapement (production) needs for each species but it is not known if existing hatchery capacities would fulfill needs in the Umatilla plus other mitigation requirements in the Columbia Basin.

Other high priority projects include upstream and downstream passage improvements at the five major diversion dams on the main stem (Three Mile Falls, Westland, Cold Springs, Maxwell, and Stanfield), and adult and smolt trapping/trucking projects. These are followed by downstream passage improvements at small diversions and habitat improvements.

Plan Evaluation

Achievement of fishery benefits identified in the plan will depend in part on a comprehensive evaluation program to determine the success of the projects. The evaluation should consist of a monitoring program such as dam counts of naturally and hatchery produced smolts and adults to provide a measure of the overall effectiveness of the rehabilitation plan. In addition, the evaluation program should include in-depth evaluations of key projects, such as hatchery/supplementation projects, passage success in the channel below and at Three Mile Falls, Westland, and possibly other dams, habitat improvements in Meacham Creek, and the Bureau of Reclamation's flow enhancement projects. Efforts to define and develop evaluation plans and costs are underway. Upon review and acceptance of evaluation plans, they will be addended to the Umatilla Rehabilitation Plan.

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Acknowledgements

I would like to thank all who contributed in development of the Umatilla Rehabilitation Plan. Development of the plan was a cooperative effort by the Oregon Department of Fish and Wildlife, the Confederated Tribes of the Umatilla Indian Reservation, the Fish and Wildlife Service, the National Marine Fisheries Service, the Bureau of Reclamation, and the Forest Service. This cooperation will greatly assist in plan implementation and restoration of salmon and steelhead runs once present in the Umatilla River. Special thanks to Jim Phelps, Gary James, Ed Chaney, Tom Vogel, Jim Esch, Rich Prange, Dave Duncan, Ron Garst, Willa Nehlsen, Dan Bottom, Larry Kern, Chuck Willis, and John Andrews for their valuable input and support throughout this work.

Raymond R. Boyce

December, 1985

Introduction

The Umatilla River once produced large runs of chinook (Oncorhynchus tschwytscha) and coho (O. Kisutch) salmon and steelhead trout (Salmo gairdneri gairdneri) which supported productive Indian and non-Indian fisheries. Chinook and coho salmon have been eliminated from the Umatilla River since the early 1900's, and summer steelhead have been reduced to a fraction of their former abundance due to habitat alterations in the basin and losses of juveniles and adults at Columbia River dams. Despite these habitat and passage problems, vast areas of potentially productive salmon and steelhead spawning and rearing habitat remain in the Umatilla Basin.

Currently, there are numerous project proposals to restore anadromous fishery resources in the Umatilla River. The Umatilla has been given top priority for restoration of salmon and steelhead by the Oregon Department of Fish and Wildlife (ODFW) and the Confederated Tribes of the Umatilla Indian Reservation (CTUIR). The ODFW and CTUIR have developed a 5-year (FY 1983-87) plan that identifies rehabilitation projects to solve fishery problems in the basin (CTUIR 1984). These projects include upstream and downstream improvements at diversion dams and canals and in the lower channel, habitat improvements in important headwater streams, and hatchery supplementation/reintroduction projects. These projects have been included in the Northwest Power Planning Council's Fish and Wildlife Program (NPPC 1984) to be considered for funding by the Bonneville Power Administration (BPA). Many of the projects have been completed of initiated: Bright fall chinook reintroduction and broodstock Development; Bonifer and Minthorn Springs adult collection/juvenile release facilities (constructed in 1983 and 1985, respectively); lower Umatilla

River channel modification (major channel work was completed in 1984 and all work will be completed in 1986); habitat improvements (projects in Squaw Creek and Minthorn Springs were completed in 1984); Umatilla River Summer Steelhead Hatchery (site investigations were completed in 1985); and Three Mile Falls Dam passage improvements (environmental assessment was completed in 1985). In addition to the CTUIR/ODFW 5-year Rehabilitation plan, the Bureau of Reclamation has identified projects to enhance flows in the basin for anadromous fish (BR 1985a). The Recommended Plan (Columbia River Pumping Plan) would allow water pumped from the Columbia River to be distributed to basin irrigation districts in exchange for McKay Reservoir storage plus natural flow rights that would be used for fish flow augmentation. The Alternative Plan (Columbia River Pumping/Meacham Dam Plan) would combine a new headwater storage reservoir on the North Fork Meacham Creek with the Columbia River Pumping Plan to further increase flows for fishery purposes.

The 5-year Rehabilitation Plan identified fishery rehabilitation objectives and developed an implementation plan to achieve objectives but did not provide a systematic evaluation of the potential fishery benefits that can be expected if one or some combination of the projects are implemented. This information is needed to identify project priorities and refine implementation schedules. BPA funded this evaluation of the proposed rehabilitation projects for the basin. There are three goals for the study:

Goal 1 Establish fishery rehabilitation objectives for naturally and hatchery produced salmonids in the Umatilla Basin.

Goal 2 Estimate potential benefits of each of the rehabilitation and flow enhancement projects to naturally and hatchery produced salmonids.

Goal 3 Develop a plan to set priorities, implement, and evaluate projects that will achieve rehabilitation objectives (Goal 1 above).

This document identifies fishery needs, quantifies the contribution of proposed fishery projects under present and enhanced flows, provides cost estimates for projects, and provides a plan for prioritization, implementation, and evaluation of projects. This report is intended to provide the Tribes, the fish and wildlife agencies and BPA a rational approach for selecting projects that will provide the greatest fishery benefits to anadromous fisheries in the basin.

In addition, although it can be interpreted that all fishery rehabilitation and flow enhancement projects have been theoretically included in the Council's Fish and Wildlife Program, the identity, scope, and nature of habitat and passage related projects are unclear. Several habitat and passage projects are referred to by a single "dot" in Table 2 of Section 704-d-1 of the Fish and Wildlife Program. Therefore, this plan also is intended to provide the Fish and Wildlife Program the necessary detail of all projects proposed for the Umatilla.

Glossary of Terms

The following definitions apply to terms that are frequently used throughout this report:

Fishery rehabilitation projects - Refers to specific passage, habitat, trapping/trucking, and hatchery production projects (see Table 8).

Flow enhancement projects - These are distinguished from the rehabilitation projects (above) and refers specifically to the Bureau of Reclamation's Columbia River Pumping and combined Columbia River Pumping/Meacham Dam Plans[a/] and the McKay Storage Plan.

Natural production - Production from fish that spawned and reared naturally regardless of the origin of the parents.

Hatchery production - Production from fish that spawned and/or reared under artificial conditions.

Production capacity (natural production) - Achievement of adult natural returns to provide maximum smolt production for the available habitat.

Rehabilitation objective (hatchery production) - Adult hatchery production goals as established by CTUIR and ODFW (CTUIR 1984).

Fishery benefit (natural production) - An estimate of the number of adults returning to the mouth of the Umatilla River after one or more projects have been completed and after the habitat has been fully seeded.

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[a]/ In this report we refer only to the flow enhancement aspects of these projects. The Columbia River Pumping (CRP) Plan as formulated by the Bureau of Reclamation (BR 1985a) also includes adult fish passage improvements at Cold Springs, Westland, and Maxwell, construction of fish screens at Stanfield, Cold Springs, Westland, and Maxwell, and a 12 year post project evaluation study. The CRP/Meacham Dam Plan includes these projects in addition to instream and riparian habitat improvements in Meacham Creek.

Fishery benefit (hatchery production) - An estimate of the number of adults returning to Bonifer and Minthorn Springs facilities after one or more projects have been completed and after the number of smolts necessary to achieve production goals is released.

Ultimate production - Adult returns to the mouth of the Umatilla (for naturally produced fish) or Bonifer and Minthorn Springs adult collection/juvenile release facilities (for hatchery produced fish) following completion of all proposed rehabilitation projects.

In addition to these terms, we have used the following agency abbreviations and shorthand terms throughout the report:

Abbreviations	Full Name
BPA	Bonneville Power Administration, U.S. Department of Energy
BR	Bureau of Reclamation, U.S. Department of the Interior
Corps or USACE	Corps of Engineers, LS. Department of the Army
CTUIR or Tribes	Confederated Tribes of the Umatilla Indian Reservation
ODFW	Oregon Department of Fish and Wildlife
FWS	Fish and Wildlife Service, C.S. Department of the Interior
NMFS	National Marine Fisheries Service, U.S. Department of Commerce
USFS	Forest Service, U.S. Department of Agriculture
Fish and Wild-life Agencies	Oregon Department of Fish and Wildlife; Fish and Wildlife Service, and National Marine Fisheries Service.

Fish and Wildlife Program	Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program
CRP Plan	Bureau of Reclamation's Columbia River Pumping Plan
CRP/Meacham	Bureau of Reclamation's combined Columbia River
Dam Plan	Pumping/Meacham Dam Plan

Basin Description

The Umatilla River in northeast Oregon originates on the west slope of the Blue Mountains east of Pendleton (Figure 1). The river flows generally in a northwesterly direction across the Umatilla Plateau for about 115 miles to its confluence with the Columbia River at RM 289. The Umatilla drainage covers 2,290 mi^2. Virtually all of the drainage is within Umatilla County, the most populous of all eastern Oregon counties. The county is in close proximity to population centers of southeastern Washington.

The average annual runoff in the Umatilla Basin is 326,700 acre-feet measured at the Umatilla Gage (RM 2.1) (USGS 1982). Average monthly flow at RM 2.1 varies from 23 cfs in July to 1,095 cfs in April. Major tributaries include the North Fork (enters the Umatilla at RM 90) and the South Fork (RM 90) Umatilla River, and Meacham (RM 79), Birch (RM 51), McKay (RM 48), and Butter (RM 15) creeks.

The terrain in headwater areas is mountainous with tributary streams in relatively narrow, steep-walled canyons (CTUIR 1984). Stream gradients range from 2-5% in the headwaters and 0.5-1.0% from the Forks to Meacham Creek.

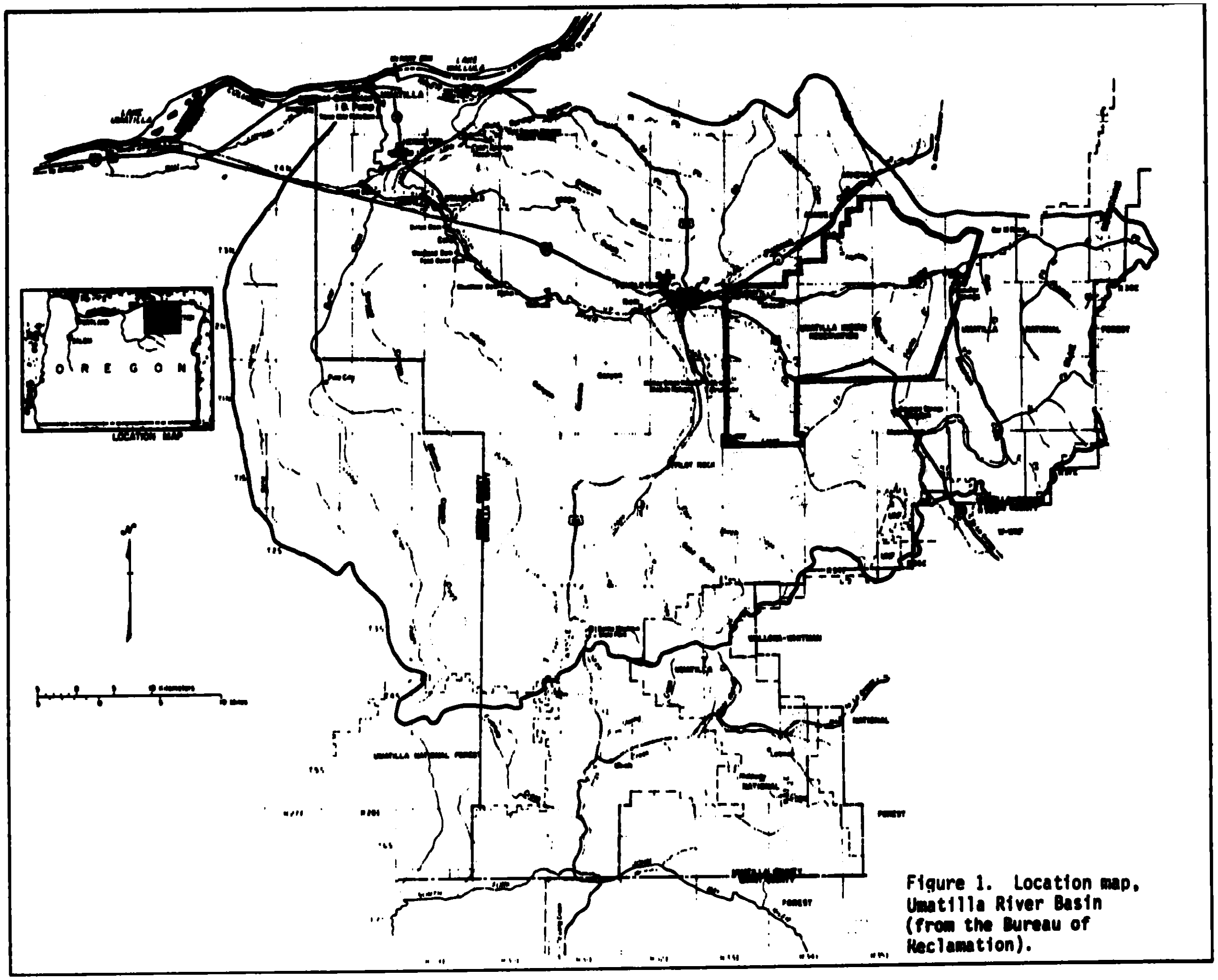


Figure 1. Location map, Umatilla River Basin (from the Bureau of Reclamation).

Below Meacham Creek, the Umatilla becomes gradually wider and gradient is less than 0.5%. Headwater areas are well shaded by a conifer canopy. On the main stem Umatilla between the Forks to Meacham Creek, a moderate amount of shading is provided by a mixture of deciduous trees and conifers. Below Meacham Creek, deciduous trees, shrubs, and grasses provide little shading as the river widens and flows through cultivated land.

About 51% of the Umatilla drainage is privately owned, 37% is managed by Federal agencies (principally the Forest Service), and 1% is owned by the State of Oregon (CTUIR 1984). Approximately 11% of the drainage (247 mi^2) is located on the Umatilla Indian Reservation, just east of Pendleton. All headwater tributaries originate in Umatilla National Forest lands.

The Umatilla has been extensively developed for irrigation purposes. The largest development is the Umatilla Project, constructed by the Bureau of Reclamation between 1906 and 1927. The project provides irrigation water to approximately 30,000 acres in four irrigation districts (Hermiston, West Extension, Stanfield, and Westland) (Figure 2). The project includes Cold Springs Dam and Reservoir, Cold Springs Diversion Dam and Feed Canal, Three Mile Falls Diversion Dam and West Extension Main Canal, and McKay Dam and Reservoir.

Cold Springs Dam and Reservoir (50,000 acre-feet capacity) are located 6 miles northeast of Hermiston. Water is diverted to the reservoir by the Feed Canal (located on the Umatilla at RM 29.2) and transported from the reservoir to the Hermiston Irrigation District through the A-Line Canal. Maxwell Diversion Dam (RM 14.8) and Canal diverts water to serve the lower Hermiston Irrigation

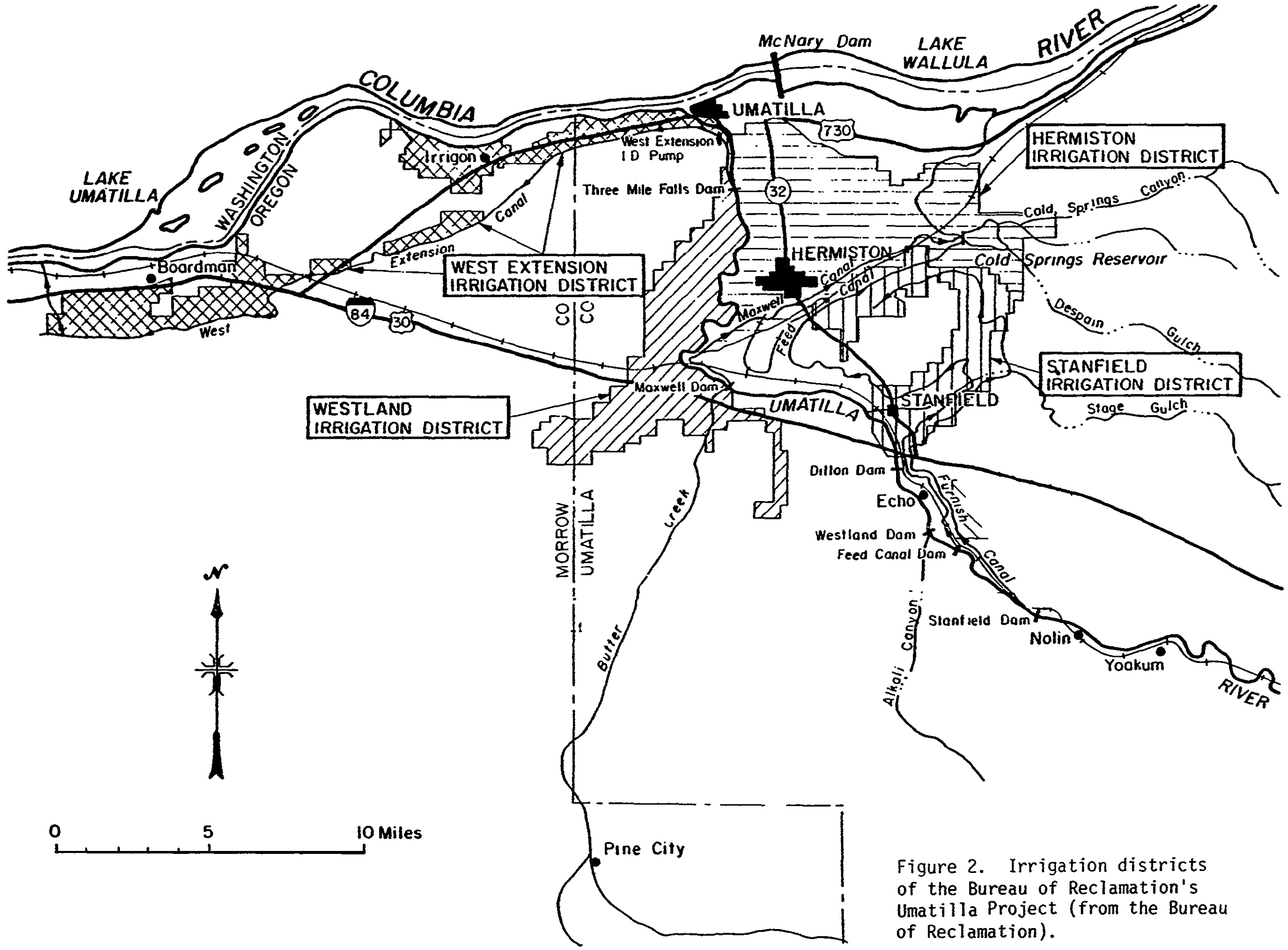


Figure 2. Irrigation districts of the Bureau of Reclamation's Umatilla Project (from the Bureau of Reclamation).

District. Three Mile Falls Diversion Dam (RM 3.0) and West Extension Main Canal diverts water for West Extension Irrigation District lands west of the Umatilla River. McKay Dam and Reservoir (73,800 acre-feet capacity, 67,800 acre-feet active capacity), located 6 miles south of Pendleton, was constructed by the Bureau of Reclamation to provide supplemental water to the Stanfield and Westland Irrigation Districts.

Stanfield Diversion Dam (RM 32.3) and Furnish Canal was constructed to provide water to the Stanfield Irrigation District. Westland Irrigation District constructed Westland Diversion Dam (RM 27.3) and Canal to divert water to the district's land on the west side of the Umatilla River. During winter, Westland Dam and Canal also provide water to the County Line Improvement District during winter to recharge the ground water aquifer. Dillon Diversion Dam (RM 24.7) and Canal, constructed by Dillon Ditch Company, diverts water to lands west of the Umatilla.

Anadromous Fishery Resources

Present and Historical Fish Runs

The Umatilla River presently supports a small run of native summer steelhead. Counts of adults at Three Mile Fails Dam during 1966/67-1982/83 averaged 1,861 (Table 1). Peak upstream migration of adults (as determined from counts at the dam) occurs in February and March and peak spawning occurs in April and May. Steelhead spawn in Meacham Creek (40% of the basin's total), the North and South Forks (27%), the upper main stem Umatilla (10%), Squaw Creek (5%), Birch Creek (15%), and other headwater tributaries (3%) (ODFW 1973).

Most steelhead rear for 2 years in headwater streams before migrating to sea. Peak downstream migration of smolts is in May as determined from counts of smolts at Umatilla screens during 1960-82 (Table 2) (ODFW 1983). Adults spend 1-2 years in the ocean before returning to spawn. Sport fishing harvest averages 700 annually (ODFW 1983). Most of this fishery is concentrated below Three Mile Falls Dam.

Historically, the Umatilla River supported runs of fall and spring chinook and coho salmon before over-fishing, extensive water use, habitat degradation, and Columbia River hydroelectric projects eliminated runs. The largest run of chinook within memory was in 1914 when Indians and non-Indians caught "thousands upon thousands of salmon from spring to fall in the lower Umatilla"

Table 1. Counts of adult summer steelhead at Three Mile Falls Dam during 1966/67-1982/83 (ODFW 1983).

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	TOTAL
1966-67	0	1	110	288	394	376	338	271	1,778
1967-68	44	174	60	281	357	14	0	0	930
1968-69	0	200	0	4	95	243	543	832	1,917
1969-70	0	0	39	7	537	407	1,299	0	2,298
1970-71 a/	0	249	404	19	-	-	-	-	NA
1971-72 b/	0								NA
1972-73	0	0	0	32	204	1,821	0	0	2,057
1973-74 c/	0	680	557	558	284	478	0	0	2,340
1974-75 d/	0	0	264	315	1,476	59	0	17	2,171
1975-76 e/	0	0	258	966	1,190	108	12	0	2,534
1976-77 f/	0	22	100	163	21	222	25	0	1,258
1977-78 g/	0	0	828	1,432	641	179	0	0	3,080
1978-79 h/									NA
1979-80	0	0	870	147	427	609	269	45	2,367
1980-81	0	210	492	319	47	142	78	10	1,298
1981-82	34	91	155	77	73	178	129	31	768
1982-83	32	95	133	218	225	276	280	5	1,264
							14-year average =		1,861

a/ Counter was damaged January 5 and not replaced.

b/ Counter was not installed.

c/ In addition to the 1973-74 total, 83 steelhead were taken as hatchery brood stock. Twelve of these (8 females and 4 males) were taken in January, and the other 71 (50 females and 21 males) were taken in February.

d/ One fish shown for May was passed upstream manually on June 4.

e/ Good numbers of fish passed upstream before the counter was operable on December 24. Therefore, this count was quite low. The ladder was opened October 22.

f/ Extremely low flows prevented steelhead passage during much of the migration period. A total of 205 steelhead (98 females and 107 males) were transported upstream near Rieth. Also the counter was not operating and passage conditions were good for a 2-week period in late March-early April. Probably at least 500 steelhead passed during that time.

g/ Counter did not operate the first 12 days after installation (November 30 to December 12). Counter was damaged by vandalism following the March 10 count and some fish were still arriving at the dam.

h/ No count was available. Counter was not calibrated accurately.

Table 2. Counts of steelhead smolts at Umatilla screens during 1960-82 (ODFW 1983).

YEAR	APRIL	MAY	JUNE	TOTAL
1960	7,098	16,469	2,342	25,909
1961	18,733*	35,689*	3,112”	57,534”
1962	,056	15,190	515	18,761
1963	1,848	17,346	1,310	20,513
1964	537	8,563	1,527”	10,627
1965	4,947	1,932	166	7,045
1966	4,619	15,709”	2,486*	22,814
1967	1,189	6,154	2,150”	9,611
1968	3,886	29,571*	4,404*	38,959
1969	556	16,352	5,905*	22,813
1970	170	1,329	8,884	10,383
1971	637	10,345	2,865	13,847
1972	706	6,257	1,457*	8,420
1973	5,218*	36,077*	3,123*	44,418*
1974	0	0	0	0
1975	0	0	3,464	3,464
1976	0	2,438	6,920	9,358
1977	6,039	89,950*	11,409*	107,398
1978	0	324	182	506
1979	0	208	2,490	2,698
1980	0	23,300	2,585	25,885
1981	175	450	150	775
1982	0	0	1,650	1,650

* These figures are total counts for the month or year indicated. All other records are incomplete.

(Van Cleve and Ting 1960). It is believed that chinook and coho salmon were eliminated from the basin shortly after completion of Three Mile Falls Dam in 1914, although some spring chinook were sighted as recently as 1963 (OSGC 1963), and fall chinook as recently as 1957 (Thompson and Haas 1960).

When reintroduced, fall chinook will arrive at the mouth of the Umatilla in peak numbers mid-September, however, because of low stream flows, adults would not be able to enter the river until November in most years. Spawning will likely occur in the main stem Umatilla during November and December. Available data on their life history suggest that juveniles will migrate to the ocean the following late spring and summer (May-July) after spending only 3-4 months in the Umatilla. Most adults will spend 3 years in the ocean before returning to spawn.

Life history data of spring chinook in other streams indicate that spring chinook will enter the Umatilla during spring months (April-June) and migrate to upstream resting pools near spawning grounds. Adults will hold over in these pools until spawning commences in August. Juveniles will rear in headwater areas for 1 year before migrating to the ocean during spring months (April-May). After spending an average 2-3 years in the ocean, adults will return to the Umatilla to spawn.

Hatchery Supplementation and Reintroduction Efforts

From 1967-69, 23,100-272,900 Skamania and Idaho (Oxbow) stock subyearlings (66-240/1b) were released in the basin (Table 3). The current program using Umatilla stock was initiated in 1980. Annually since 1981, up to

Table 3. Hatchery releases of summer steelhead, fall chinook, and coho in the Umatilla River.

Year of Release	Hatchery	No. Released	No. / lb.	Stock
Summer Steelhead				
1967	Gnat Creek	109,805	75.0	Skamania
1967	Oak Springs	272,900	117.0	Idaho (Oxbow)
1967	Wallowa	142,240	240.0	Idaho (Oxbow)
1968	Gnat Creek	23,100	66.0	Skamania
1969	Oak Springs	174,341	145.0	Skamania
1981	Oak Springs	17,558	6.9	Umatilla River
1981	Oak Springs	9,400	149.2	Umatilla River
1982	Oak Springs	59,534	7.6-8.0	Umatilla River
1982	Oak Springs	67,980	123.6	Umatilla River
1983	Oak Springs	60,500	11.0	Umatilla River
1983	Oak Springs	52,700	62.0	Umatilla River
1984	Oak Springs	58,012	6.0-6.9	Umatilla River
1984	Oak Springs	22,005	135.0	Umatilla River
Fall Chinoook				
1982	Bonneville	978,336	79.0	Tule
1982	Bonneville	2,559,510	50.0	Tule
1982	Bonneville	290,680	130.0	Tule
1983	Bonneville	100,000	5.6-6.2	Upper River Bright
1984	Bonneville	223,632	8.6-9.3	Upper River Bright
1984	Bonneville	637,190	86.0-87.0	Upper River Bright
Coho				
1966	Little White Salmon	500,000	1312.0	Little White Salmon
1967	Little White Salmon	200,000	1087.0	Little White Salmon
	Cascade	500,000	Eggs	Tanner Creek
1968	Little White Salmon	750,000	Eggs	Little White Salmon
1969	Carson	200,040	23.0	Little White Salmon

60,500 yearlings (6.9-11.0/lb) and 67,980 subyearlings (62.0-149.2/1b) have been released. Most steelhead adults resulting from the first large hatcher-y release (1982) returned during the winter of 1984/85 as 2-salt adults. All hatchery releases have been made with progeny of native summer steelhead trapped at Three Mile Falls Dam. Broodstock take is approximately 75 females and 25 males per year. Broodstock are spawned at Bonifer Springs facility on the Umatilla Indian Reservation and juveniles are reared at Oak Springs Hatchery on the Deschutes River for 1 year. Smolts are released into the Umatilla during April and May. When constructed, juveniles will be reared at the Umatilla River Summer Steelhead Hatchery.

Reintroduction of fall chinook into the Umatilla River began in 1982. Tule stock subyearlings (79.0-130.0/1b) were released in 1982 (3.83 million) and upper river bright yearlings (5.6-9.3/1b) were released in 1983 (100,000) and 1984 (223,632) (Table 3). In 1984, a release of 637,190 upper river bright subyearlings (86.0-87.0/1b) was made. Most upper river bright adults resulting from the 1983 hatchery release will return in the fall of 1985 as age 42 adults. Only upper river bright (late adults) stock will be used in future hatchery releases. Eggs will be taken and juveniles reared at Bonneville Hatchery.

Spring chinook have yet to be reintroduced into the Umatilla Basin but the first release of spring chinook (Carson stock) will be made in 1986.

Coho were introduced into the basin during 1966-69 (Table 3) although these introductions did not result in reestablishment of runs. Plans have not yet been made to reintroduce coho in the basin.

Factors Limiting Anadromous Fish Production and Needs

Main Stem Umatilla River

Stream Flow and Temperature

Low stream flow is the chief factor limiting production of anadromous salmonids in the Umatilla Basin. Salmonid production in the basin is directly related to the level of summer and fall flows in juvenile rearing streams (Giger 1973; Marshall and Britton 1980; McIntyre 1983). The low flow period will be the most critical time for young steelhead and spring chinook in the Umatilla Basin. Summer months are most critical to salmonids due to naturally low stream flows (Figure 3) and numerous irrigation diversions in the lower river. Six major irrigation diversions in the lower 32 miles of the main stem (Stanfield, Cold Springs, Westland, Dillon, Maxwell, and Three Mile Falls Dam) remove water April through September (Table 4). Water withdrawals during summer and fall months often cause dewatering of some reaches in the main stem which eliminates rearing area for salmonids. Water temperatures in the lower mainstem typically exceed 80°F (ODFW 1973) which exceed upper lethal temperatures of anadromous salmonids (75.78°F) (Reiser and Bjornn 1979). Suitable summer rearing habitat for salmonids during summer is found only in upper areas of the watershed.

High summer and fall water temperatures favor nongame species (mainly date, redside shiners, squawfish, suckers, and carp) to flourish in potential salmonid habitat. The Umatilla was chemically treated in 1967 and 1978 by ODFW to control nongame fish. Chemical treatment to control nongame fish is likely to be futile, however, unless water temperatures are reduced.

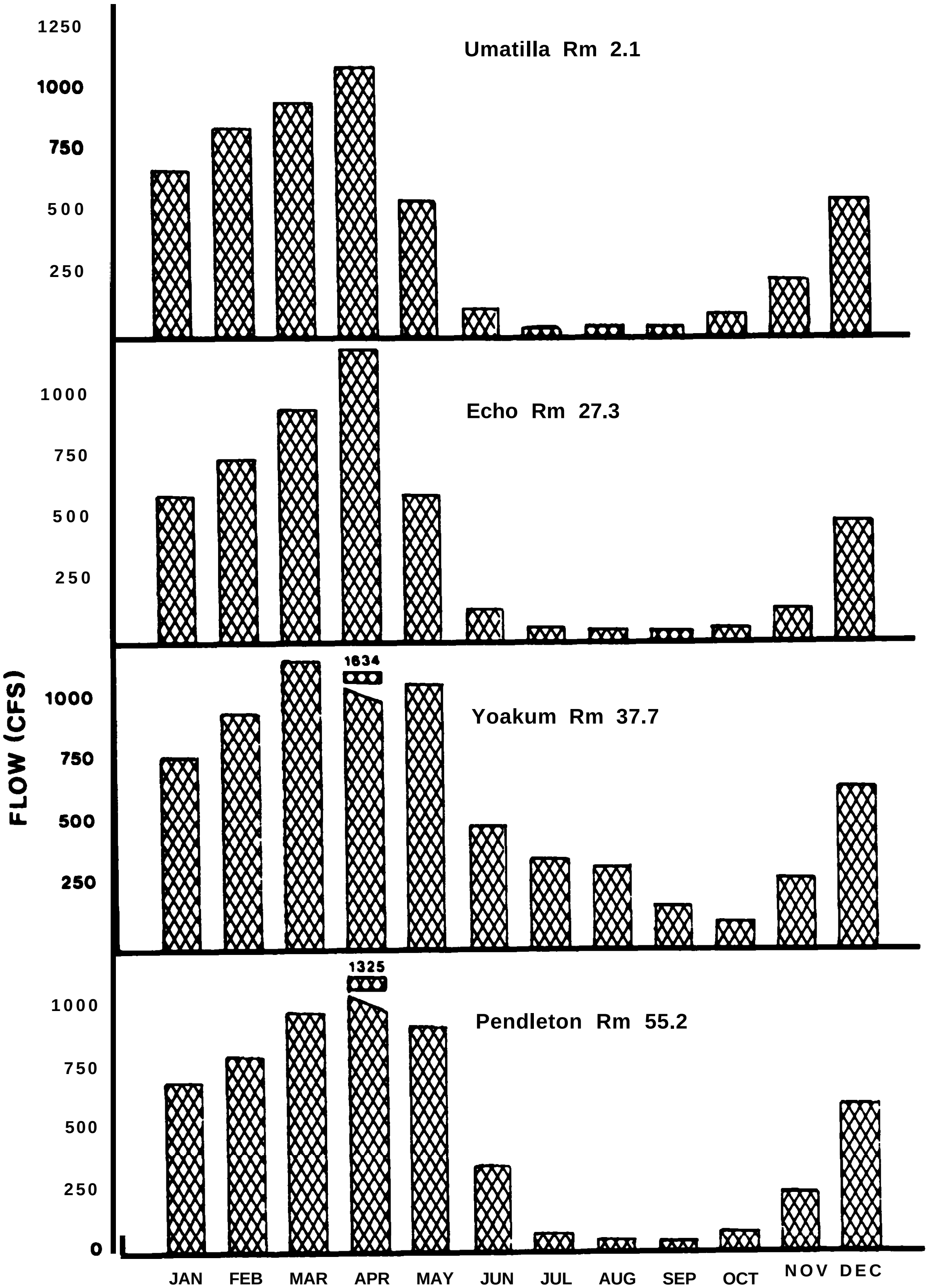


Figure 3. Average monthly flows (40-50 year averages)[a/] in the main-stem Umatilla River.

a/ USGS data compiled by BR (1983).

Table 4. Major diversions in the lower Umatilla River during a typical year (diversion data are from USGS 1970)

			Diversions in cfs[a/]			
Month	Stanfield	Cold Springs	Dillon	Westland	Maxwell	West Extension
October	0.5	0	5	2	18	36
November	0	55		0	0	0
December	0	119	-	0	0	0
January	0	136		0	0	0
February	0	216		0	0	0
March	0	249	-	3	0	11
April	85	205	-	157	51	142
May	120	250	8	202	64	153
June	112	66	11	188	60	156
July	114	0	15	199	50	171
August	104	0	16	189	55	162
September	66	0	5	118	58	132

a/ No gage-height record for months of little or no flow and short periods at other times.

Low stream flows can also limit upstream passage of adults. Cold Springs Diversion Dam diverts water from November through June to fill Cold Springs Reservoir. Additional water is diverted November through May in McKay Creek to fill McKay Creek Reservoir. When flows permit, Westland Diversion Dam diverts during the winter to recharge ground water levels. Late fall and winter diversions at Cold Springs, McKay Creek, and Westland during years of low runoff can hinder upstream passage of summer steelhead and fall chinook. Channel areas between Maxwell (Rm 14.8) and Westland (Rm 27.3) Diversion Dams are especially limiting to the upstream passage of fall chinook due to extremely low flows during fall months. As will be discussed later, a flow of at least 250 cfs is required for passage of adults in the lower 32 miles of the river. However, as shown in Table 11 in the next section, even in average water years, Umatilla flows do not reach 250 cfs from the mouth to river mile 32 until November.

If spring chinook were introduced, irrigation withdrawals during spring months would often impede upstream migration and passage of adults under present low flow conditions. On the average, flows are adequate (>250 cfs) for adult passage in April and May throughout the lower river but are inadequate in June below Cold Springs Diversion Dam (RM 29.2). In addition to passage problems in the lower river, oversummering spring chinook adults will be faced with a lack of deep pools in the upper drainage.

Low stream flows can also inhibit downstream passage of juveniles. During average water years there is sufficient flow to allow safe passage for downstream migrants during the principal months of migration (April-June). However, during years of low runoff, most flow is diverted for irrigation or stored in reservoirs. When these low flow conditions occur (approximately 1 in 10 years), all steelhead are trapped at Westland and trucked to the Columbia River.

Table 5 shows minimum stream flows that have been adopted by the State Water Resources Commission for the main stem Umatilla River from the Meacham Creek confluence to the mouth (a distance of 79 miles) and for the main stem Birch Creek (a distance of 16 miles). Flows in the Umatilla are below recommended minimums in most years during June-November. These stream flows are needed to provide transportation water for passage of adult summer steelhead and spring chinook to headwater spawning and rearing areas and to provide adequate conditions for the downstream migration of smolts during spring months. The minimum flows would provide adequate conditions for all life stages of fall chinook that spawned downstream of Meacham Creek and would provide transportation flows for fish that spawned above Meacham Creek. Minimum flows

Table 5. Minimum stream flows for the Umatilla Basin (adopted by the State Water Resources Commission in December 1985 with a 11-03-83 priority date) pursuant to Senate Bill 225.

Month/Area | **Purpose**

Umatilla River: McKay Creek to Mouth

Oct	Nov 1-15	Nov 16-30	Dec-Jun	Jul	Aug	Sep 1-15	Sep 16-30	Purpose
300	300	250	250	120	85	85	250	For chinook, steelhead, and resident trout migration and production. For support of anadromous species and resident and catchable trout fisheries. Assimilation of treated wastes and water qualty.

Umatilla River: Meacham Creek Downstream to McKay Creek

Oct	Nov	Dec-Jan	Feb-May	Jun	Jul	Aug-Sep	Purpose
200	200	200	240	200	100	60	For chinook, steelhead, and resident trout migration and production. For support of anadromous species and resident and catchable trout fisheries. Fishery flows adequate for assimilation of treated wastes and for water quality.

Birch Creek: Forks to Mouth

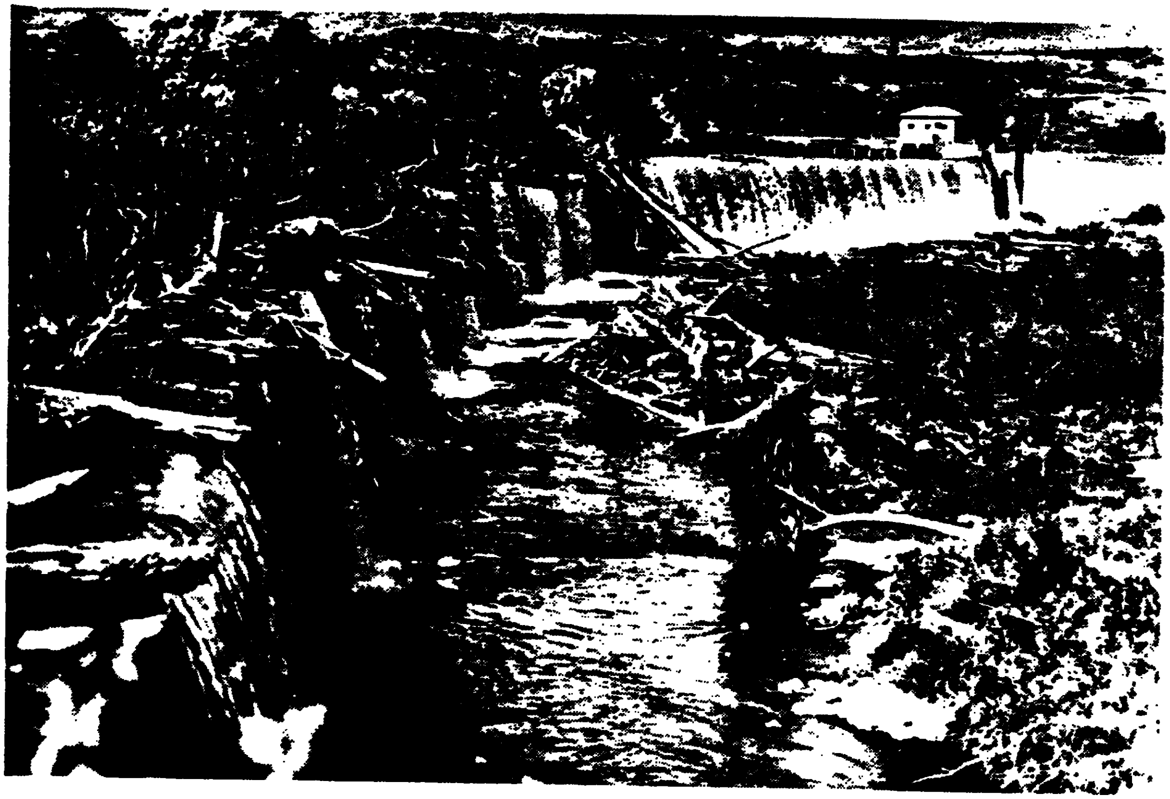
Oct	Nov	Dec-Jan	Feb-May	Jun	Jul	Aug-Sep	Purpose
8	8	20	30	20	12	8	For chinook steelhead and resident trout production.

recommended by ODFW in 1973 for other areas of the Umatilla are presented in Appendix A.

Restricted Adult Passage at Diversion Dams

Five Umatilla River irrigation diversion dams limit upstream fish migration. Three Mile Falls Diversion Dam (RM 3.0) is the highest diversion dam on the Umatilla (24 ft crest height) (Figure 4) and is a formidable obstacle to upstream migration of adults. It is a concrete buttress dam with a crest length of 915 feet. The dam was constructed by the Bureau of Reclamation in 1914 as part of the Umatilla Project. A FWS report (1984) concluded that the ladder system presented problems for passage of adults at all flows. At low to medium flows, passage is somewhat successful at the two ladders. As flows increase above 500 cfs, a higher percentage of water spills over the crest of the dam and causes a false attraction problem for steelhead and chinook in the tailrace area. The resulting migration delay increases stress and mortality when fish jump and become trapped in the open bays beneath the dam (Figure 4). An estimated 20% of the 1982-83 steelhead run was lost to entrapment beneath the dam. Migration delays for spring chinook would be more harmful than summer steelhead because adults must reach holding pools in cool headwater areas before main stem summer temperatures become excessive.

The west ladder at Three Mile Falls Dam is designed properly but the east ladder is improperly designed by today's standards (FWS 1984). It has poor pool dimensions and drop between pools, lacks self-regulation flow design, and lacks adequate attraction water at all flow levels (Figure 5). The overflow weir design of the east ladder is much less efficient for chinook passage than



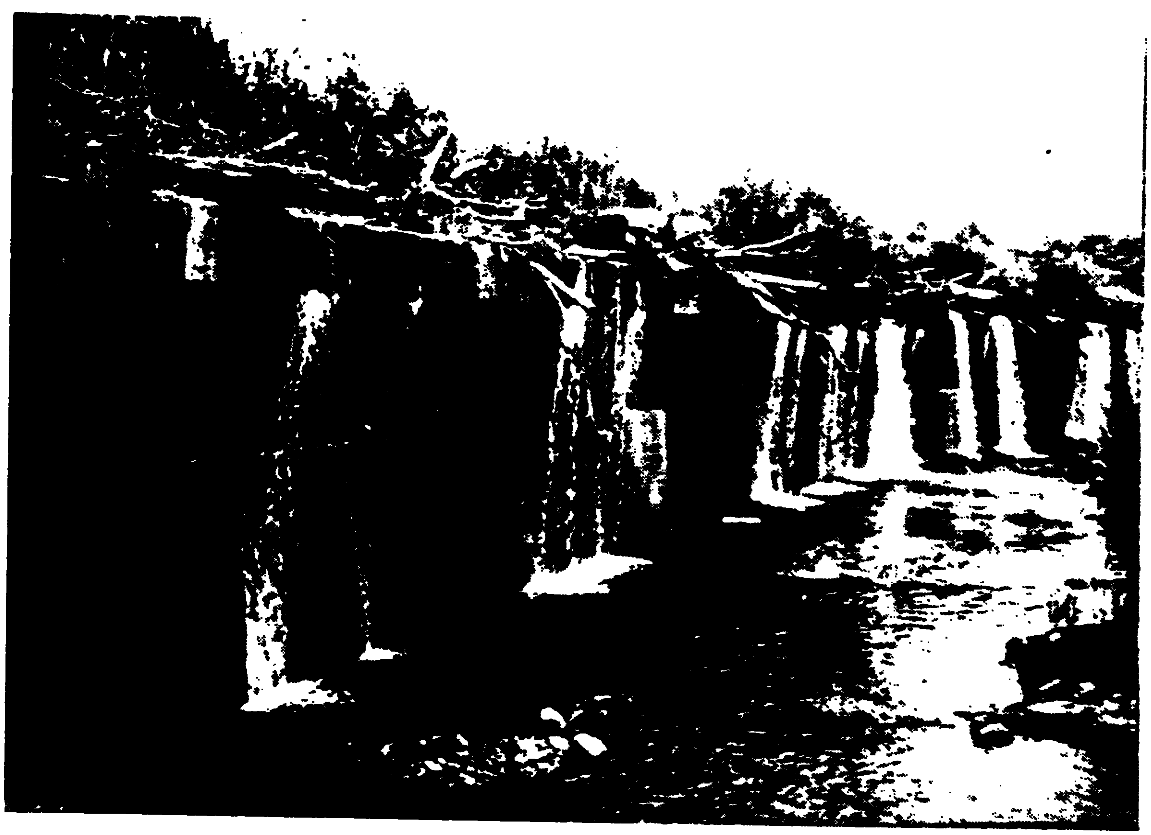


Figure 4. Three Mile Falls Diversion Dam (3.0) looking west from the east ladder (upper photo). Note attraction flows over the dam and debris accumulation. Open bays beneath the dam (lower photo) shown at a lower flow.

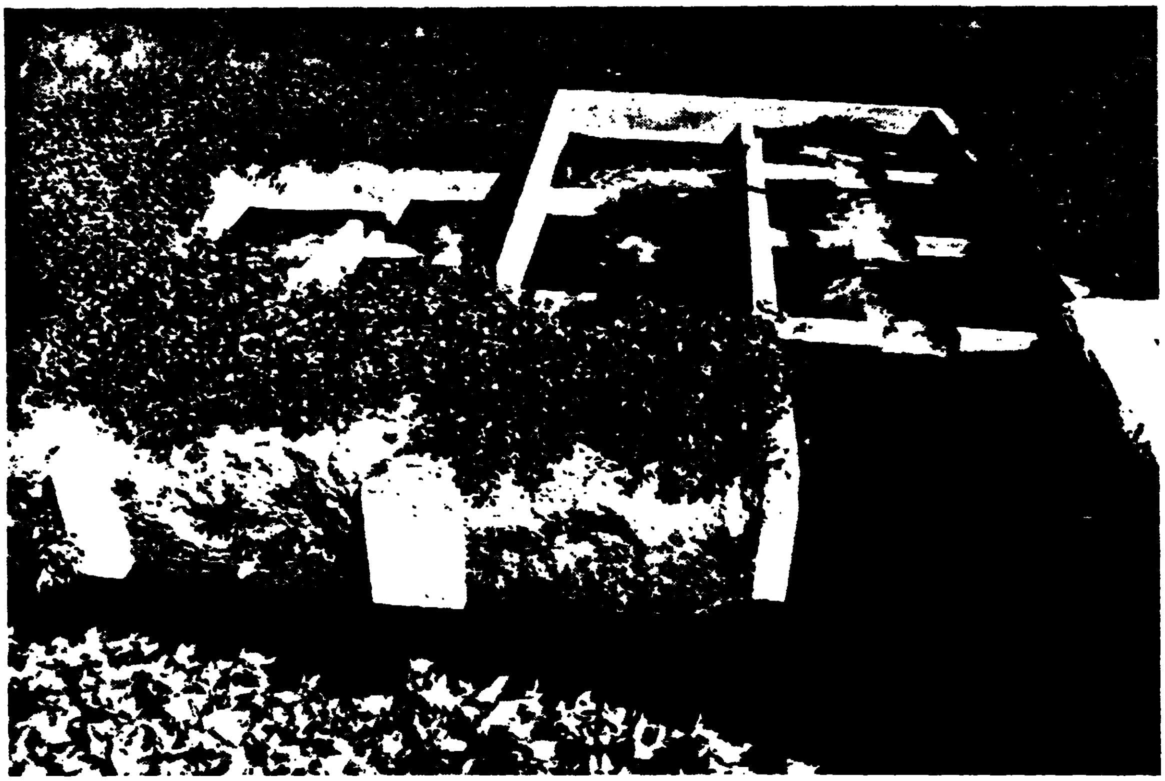


Figure 5. East ladder at Three Mile Falls Diversion Dam (R.M. 3.0) (upper photo) showing the overflow weir design. Fish access to the east ladder is poor due to lack of a well defined channel (lower photo). Photos are from the Fish and Wildlife Service.

would a vertical slot design. The natural accumulation of sediment and debris above the east side of the dam restricts flow and impedes fish passage through the east ladder. Fish access to the east ladder is poor due to lack of a well defined channel (Figure 5). There are no trapping or counting facilities at the east ladder and only marginal facilities at the west ladder. Accumulation of debris over the dam crest and tailrace area can inhibit lateral movement along the base of the dam and may further delay migration of steelhead and chinook.

Westland Diversion Dam (RM 27.3) is 4 ft high at the spillway with a 2 ft high sill (Figure 6). Due to extensive scouring, the pool depth below the dam is very shallow except at high flows. At low to medium flows, adults do not have an adequate pool depth below the dam and over the face of the dam for successful passage.

Stanfield Diversion Dam (RM 32.3) is also 4 ft high at the spillway with a 2 ft high sill (Figure 7). The dam is equipped with collapsible boards and there are 10 ft spillways on each side of the dam. From June to October when the dam boards are up and flows are low, the dam is a barrier to adults.

Maxwell and Cold Springs Diversion Dams, located at river miles 14.8 and 29.2, respectively, are 2 ft high dams with uniform flow across their crests (Figure 8). Each has a concrete apron which extends along its base on the downstream side. At low water levels, adults seldom have sufficient depth over the apron to jump the dam.

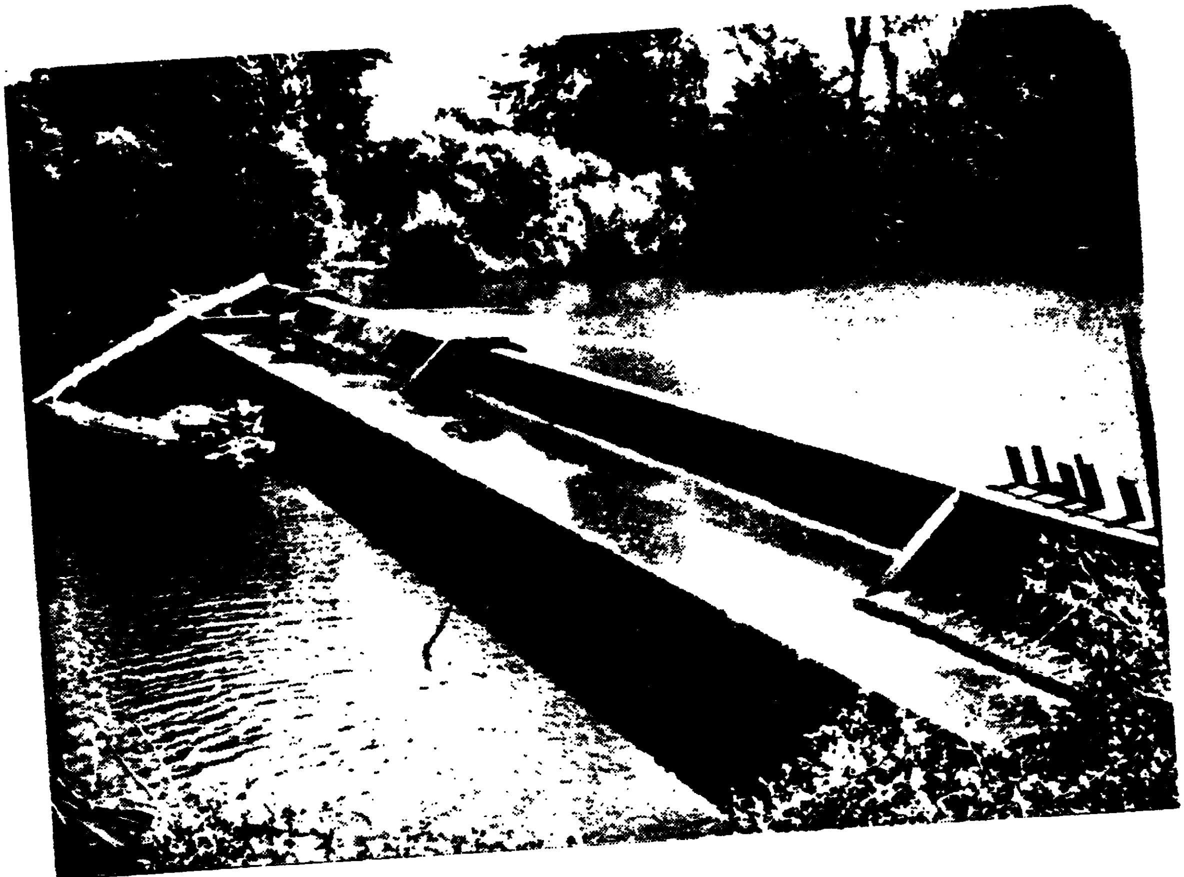


Figure 6. Westland (R.M. 27.3) (upper photo) and Dillon (R.M. 24.7) (lower photo) Diversion Dams. Photos are from CTUIR.

Figure 7. Stanfield Diversion Dam (R.M. 32.3) with collapsible boards up.

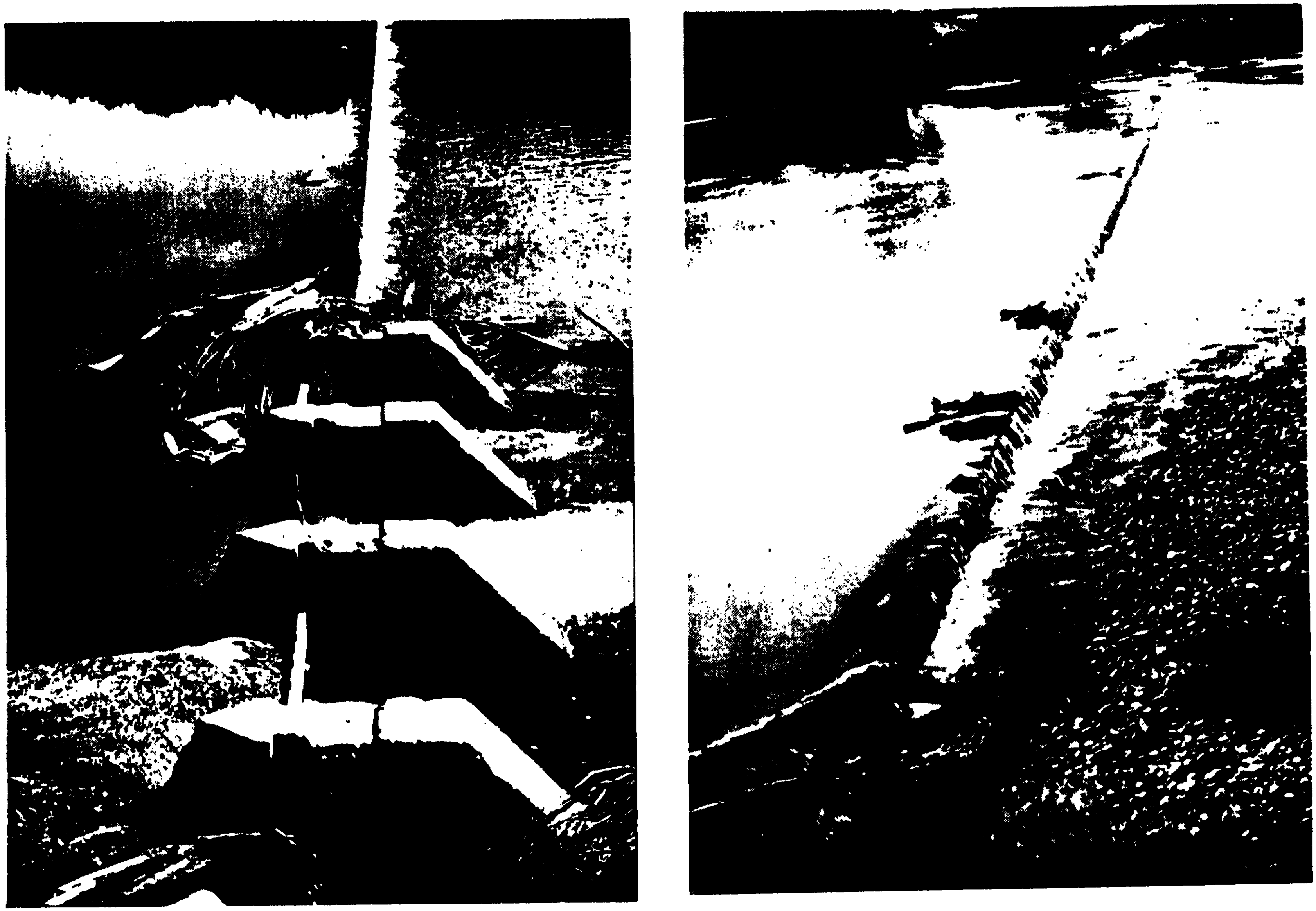


Figure 8. Maxwell (R.M. 14.8) (left photo) and Cold Springs (R.M 29.2) (right photo) Diversion Dams.

Two other diversion dams, Brownell (RM 1.0) and Dillon (RM 24.7), presently do not inhibit adult passage. Brownell Dam is 2 feet high and provides uniform flows along the crest. The dam may have had an inadequate jump pool during low flows until 1984 when a jump pool was created as part of the lower channel modification project. The Dillon Diversion Dam is 4 feet high and is equipped with two fish ladders (Figure 6). These ladders provide good upstream passage conditions for adults at all flows.

The Bureau of Reclamation, in cooperation with the tribes and the fish and wildlife agencies, is under contract with BPA to develop and implement a program to improve fish passage problems at Three Mile Falls Dam as part of the Fish and Wildlife Program. Passage improvements at all diversion dams were included in the Fish and Wildlife Program (FW Program Reference 704-d-1, Table 2) although funding proposals have only been submitted for Three Mile Falls Dam.

Adult Passage Below Three Mile Falls Dam

During low streamflow, much of the Umatilla River channel below Three Mile Falls Dam has bedrock flats, an undefined channel, dead-end channels, and shallow pools which inhibit upstream passage of adults, particularly fall and spring chinook. During the steelhead migration, flows are usually adequate for successful passage. During the chinook migration period, low flows in the channel probably pose a complete barrier to adults.

In 1984 as part of the Fish and Wildlife Program, the USACE began a channel improvement project. Through blasting and excavation, a 10 ft wide, 5 ft deep channel will be created in bedrock areas (Figure 9). A total of 3,380 lineal feet of bedrock will be modified in the 3 miles below the dam.

Fish Screening at Irrigation Diversions

The Umatilla Basin has an extensive network of screened and unscreened diversions located on the main stem Umatilla and on the main stem Birch Creek and tributaries (Table 6). All of the major irrigation diversions in the lower 32 miles of the Umatilla are screened. These include rotary drum screens on Furnish Canal (Stanfield) (Stanfield Irrigation District), Feed Canal (Cold Springs) (Hermiston Irrigation District), Westland Main Canal (Westland Irrigation District), Dillon Canal (Dillon Ditch Company), Maxwell Canal (Hermiston Irrigation District), and a louver system at Three Mile Falls Dam (West Extension Irrigation District) (Figures 10-13). The fish and wildlife agencies have established screen mesh opening and approach velocity criteria for passage of juveniles. These criteria are:

Fish Category	Screen Mesh Opening	Approach Velocity
Fry (Maximum length: 59 mm)	1/8" (3.2 mm) minimum	0.5 ft/sec maximum
Fingerling (Minimum length: 60 mm)	1/4" (6.4 mm) minimum	1.0 ft/sec maximum

Naturally produced steelhead and spring chinook juveniles migrating down the Umatilla fit into the "fingerling" category whereas fall chinook juveniles are in the "fry" category. As shown in Table 7, screen mesh openings meet criteria for passage of steelhead and spring chinook at all rotary drum screens in the Umatilla, but do not meet standards at Cold Springs, Westland,

Figure 9. A section of the lower Umatilla River channel below Three Mile Falls Dam near R.M. 1.4 before (upper photo) and after (lower photo) channel modification.

Table 6. Irrigation diversions in the Umatilla Basin

Stream/Diversion	River Mile	Status [a]
Umatilla River		
Brownell Ditch	1.0	Screened
West Extension	3.0	Screened
Maxwell Canal	14.8	Screened
Dillon Canal	24.7	Screened
Westland Canal	27.3	Screened
Wilson Ditch (2 ditches)	29.0	Unscreened
Feed Canal (Cold Springs)	29.2	Screened
Cunha Ditch	30.0	Unscreened
Furnish Canal (Stanfield)	32.3	Screened
Brown's Dairy	47.0	Unscreened
Johns, Smith, Beamer Ditch	48.8	Unscreened [b]
Wyss Ditch	50.8	Unscreened
Crispin Ditch	57.0	Unscreened
Birch Creek		
Johns, Smith, Beamer Canal	0.3	Unscreened
Kuhn Ditch	2.8	Unscreened
Straughan Ditch	4.8	Unscreened
Elridge and Hummel Ditch	10.2	Unscreened
Gambell Ditch	14.5	Unscreened
L. P. Ditch	16.0	Unscreened
East Fork Birch Creek		
Sherrill Ditch	2.1	Unscreened
Cortazar Ditch	7.2	Unscreened
West Fork Birch Creek		
Hutchinson Ditch	1.0	Unscreened
Cunningham Ditch	2.5	Unscreened

a All screened diversions are equipped with rotary drum screens except for West Extension at Three Mile Falls Dam which has a louver system.

b Inactive; all others are active

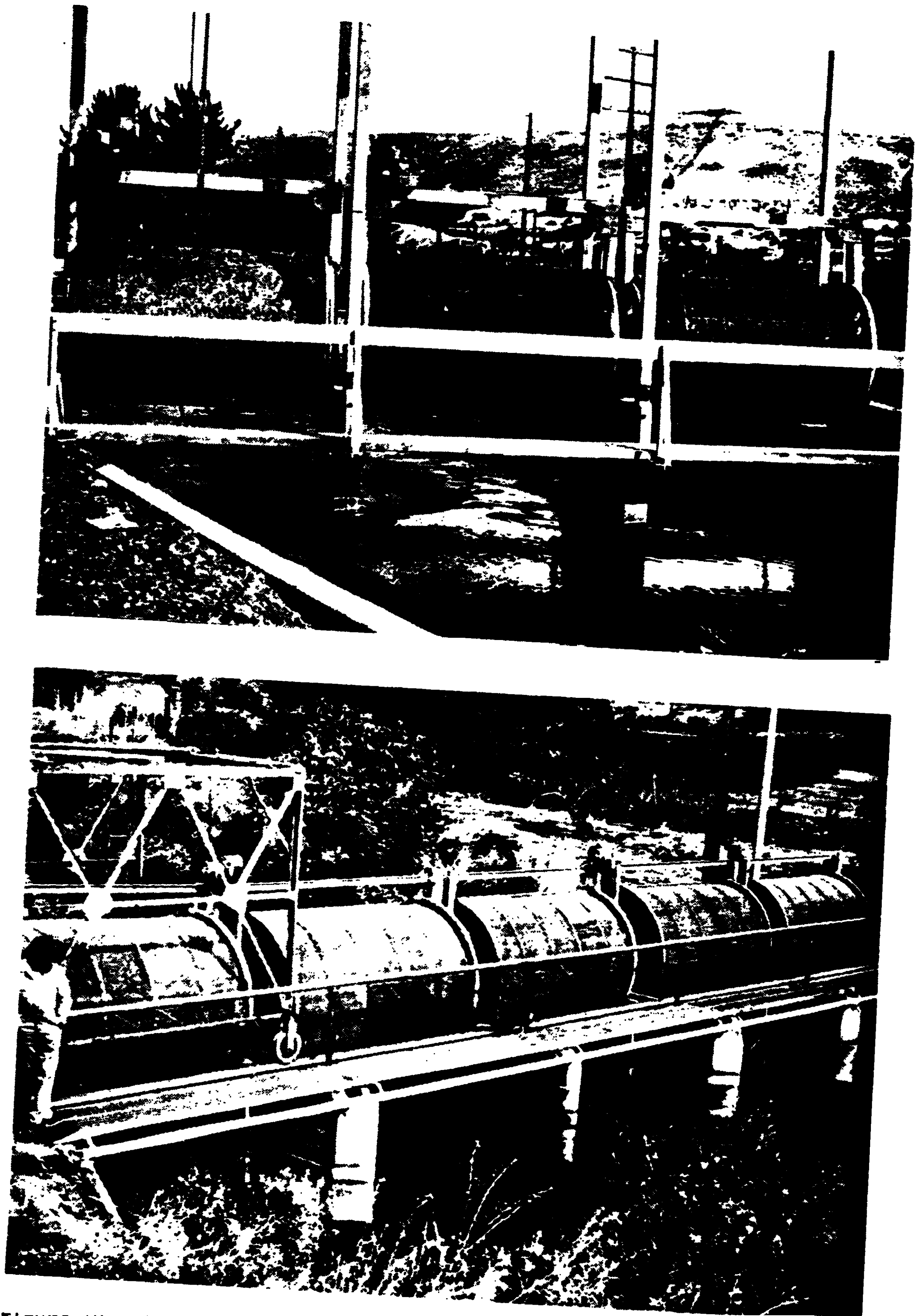
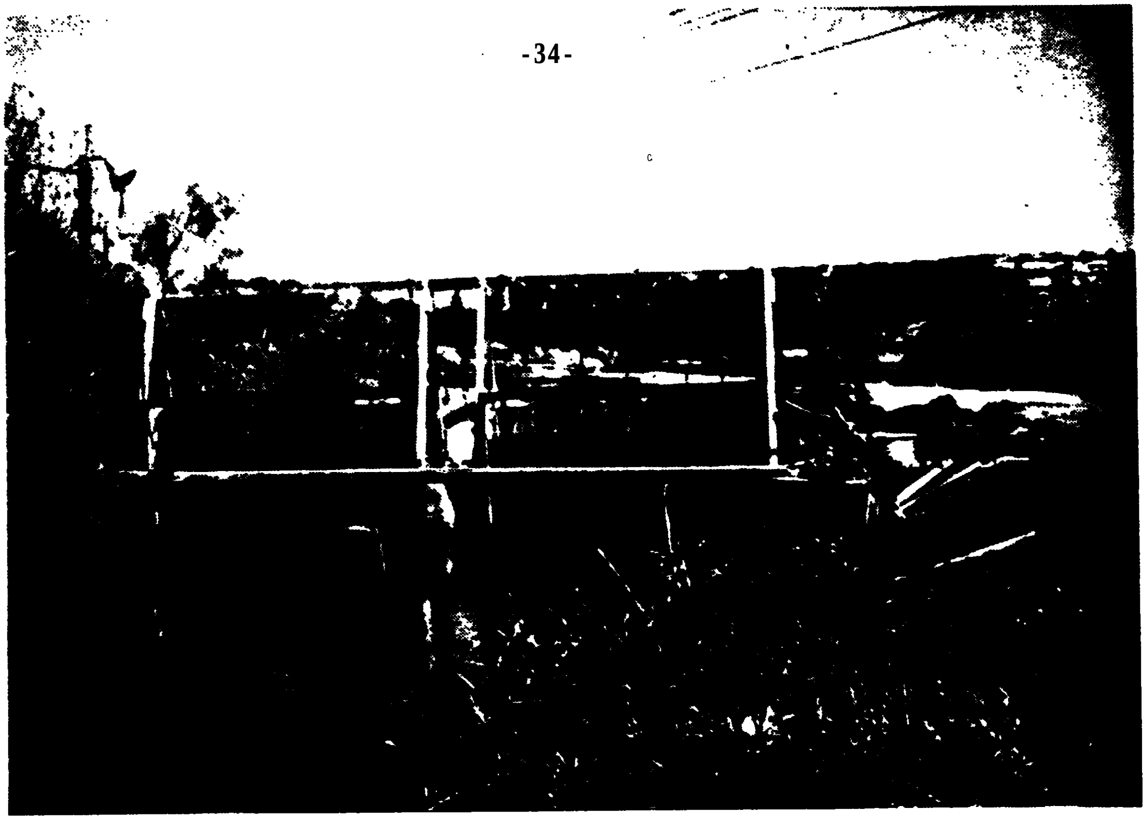


Figure 10. Stanfield (upper photo) and Cold Springs (lower photo) Screens.



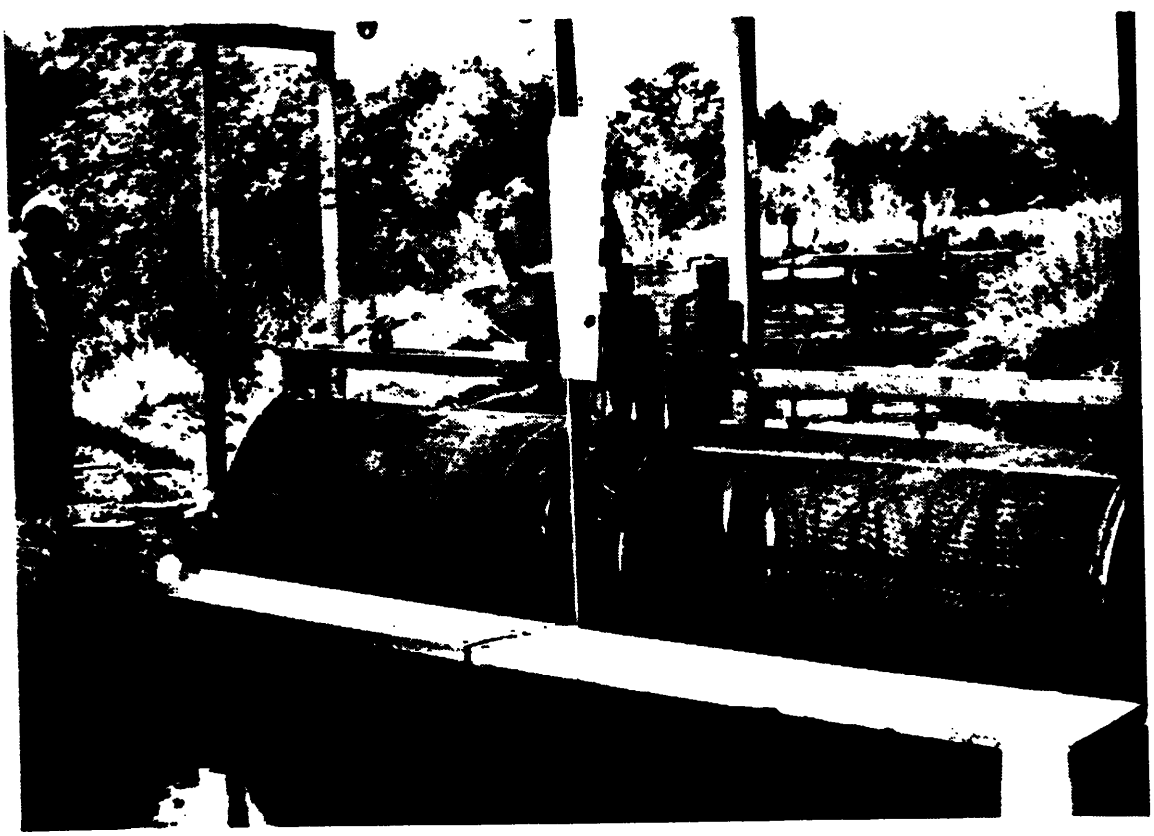


Figure 11. Westland (upper photo) and Maxwell (lower photo) Screens.

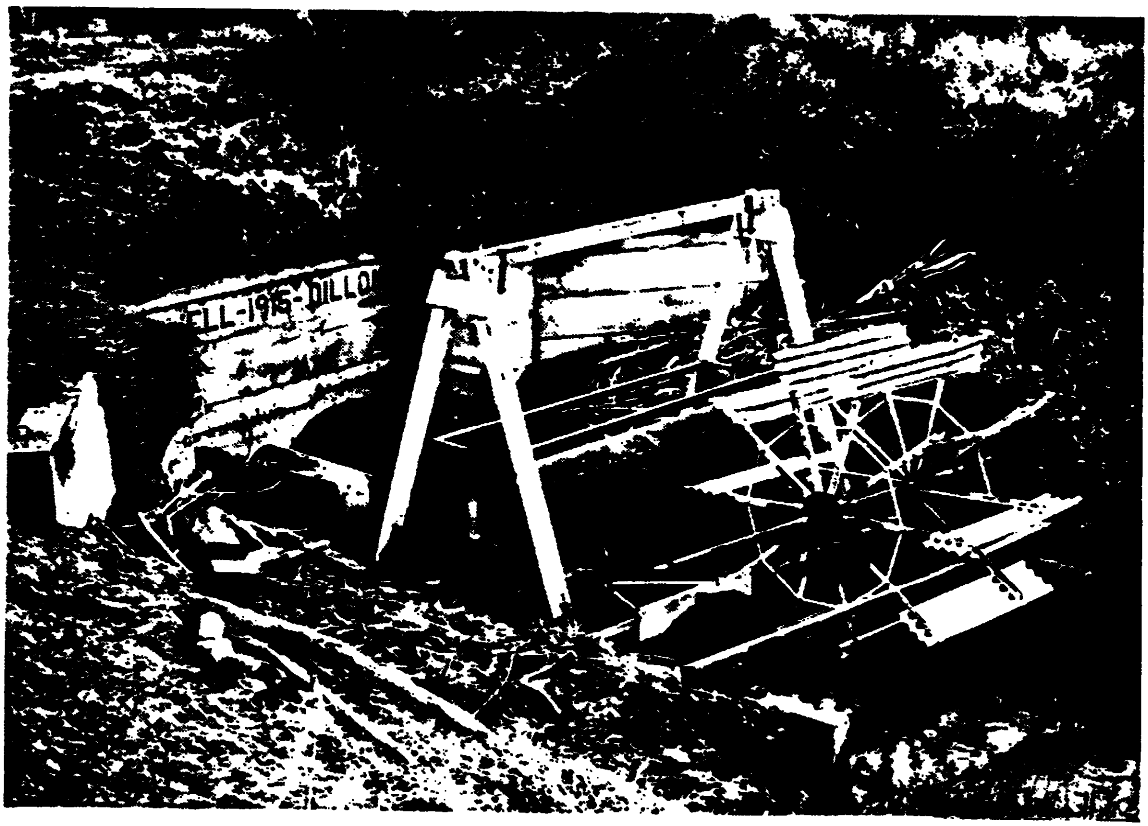


Figure 12. Dillon Screen.

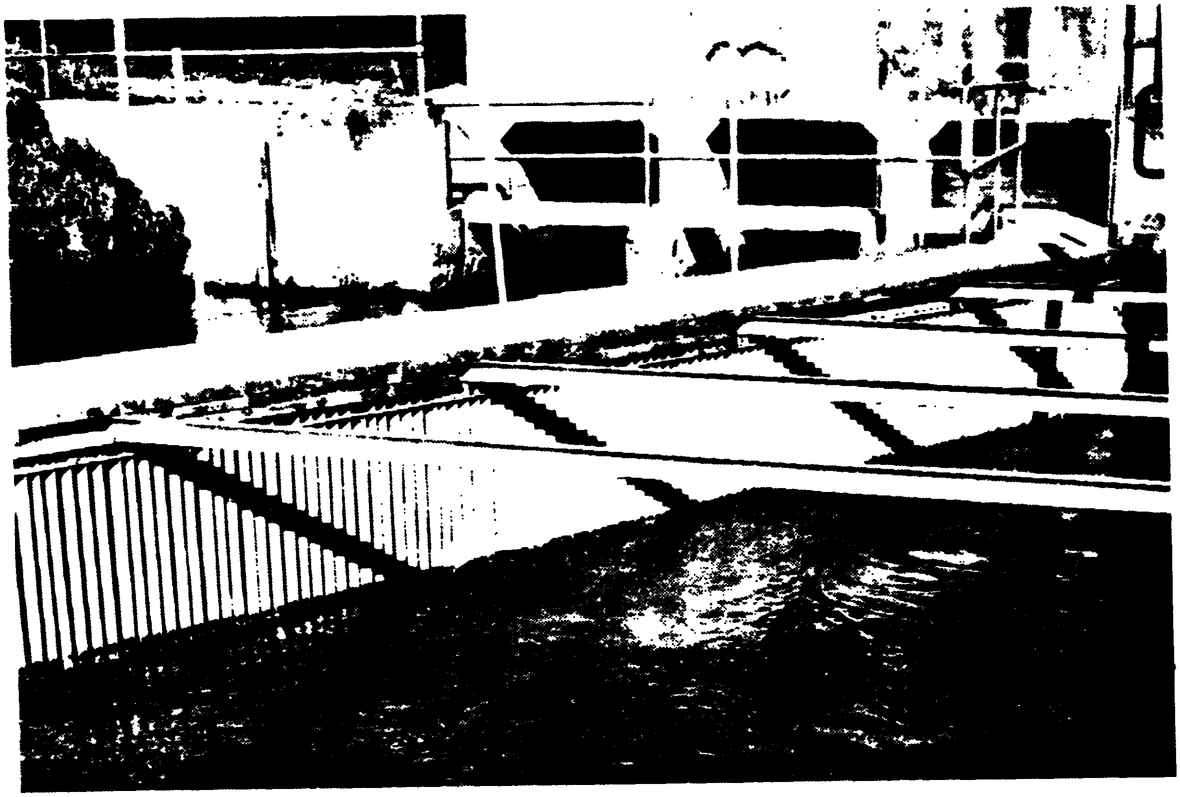


Figure 13. Louvre system at Three Mile Falls Dam (upper photo). Juvenile bypass outlet pipe and entrance to the west ladder (lower photo). Photos are from the Fish and Wildlife Service.

Table 7 Screened irrigation diversions in the Umatilla drainage.

	Diversion	Location	Screen Type	Screen Area (ft^2) [a]	Water Diverted (cfs)[b] April	May	June	July	Water Velocity (ft/sec) at screen[c]	Screen Size	Bypass System
1)	Stanfield (Furnish Canal)	Rm 32.3 (0.5 mi)[d]	Three 5'x8' drums	90	90	118	121	124	April-1.00 May -1.31 June -1.34 July-1.38	5 mesh, 16 gauge (1/8" opening)	12" pipe (6" orifice) on bottom
2)	Cold Springs (Feed Canal)	Rm 29.2 (0.25 mi)	Five 6'x10' drums	225	176	165	54	1	April-0.78 May -0.73 June -0.24 July-0.00	3 mesh, 12 gauge (3/16" opening)	18" pipe (6" orifice) on bottom
3)	Westland Canal	Rm 27.3 (0.25 mi)	Two 5'x11.5' drums	86	186	210	206	211	April-2.16 May -2.44 June -2.40 July-2.46	3 mesh, 16 gauge (1/4" opening)	8" pipe (6" orifice) on bottom
4)	Dillon Canal	Rm 24.7 (near entrance)	One 2'x7.5' drum	11	5	2	7	9	April-0.45 May -0.18 June -0.64 July-0.82	5 mesh, 16 gauge (1/8" opening)	None-fish need to swim back upstream 15 ft
5)	Maxwell Canal	Rm 14.8 (1.5 mi)	Two 4'x8' drums	48	55	68	54	44	April-1.14 May -1.42 June -1.13 July-0.92	4 mesh, 12 gauge (<5/32" opening)	6" vertical slot
6)	West Extension	Rm 3.0 (at entrance)	30'x10' louvre	90	156	168	164	166	April-1.73 May -1.87 June -1.82 July-1.84	1-2" spacing between slats	8" vertical slot
7)	Brownell Ditch	Rm 1.0 (0.25 mi)	One 31"x91" drum	15	(2.1 cfs water right)				(0.14 water right)	5 mesh, 16 gauge (1/8" opening)	3 foot gate

[a] Assuming 3/4 submergence

[b] Data from BR (1983)

[c] Calculated by: $\dfrac{\text{Water Diverted in Month i}}{\text{Screen Area}}$

[d] Location of diversion dam and distance of screen down canal (in parenthesis)

Note: Approximately 10% flow is spilled below screens at Stanfield, Westland, and Maxwell which is not recorded at gaging stations.

and Maxwell for passage of fall chinook. Approach velocities during months of peak downstream, migration [April-July) generally do not meet criteria at Stanfield, Westland, and Maxwell for passage of steelhead and spring chinook and do not meet criteria at ail diversions except at Brownell for passage of fall chinook.

The lower at Three Mile Falls Dam is a 30 ft long grate with a series of fixed metal slats spaced 1 to 2 inches apart (Figure 13). A NMFS (Pearce 1954) study indicates that passage efficiency of this type under ideal flow conditions is 70-95% for summer- steelhead, 40-90% for fall chinook, and 60-90% for spring chinook. The FWS (1984) felt that passage conditions at Three Mile Dam are probably on the law end of these ranges because of problems with approach velocities, nonlaminar flows, and bypass slot velocities. Passage of juveniles past the dam is accomplished by passing over the crest of the dam (a 24 ft drop) or through an 15 inch bypass pipe that drops fish 18 feet into a tailrace pool (Figure 13). The drop of fish over the dam or though the bypass may result in significant injury and mortality of juveniles.

The fish and wildlife agencies have developed criteria for placement of fish screens in canals. Screens should be installed at the canal entrance to minimize injury to juveniles and avoid dewatering long stretches of the river. The distances involved now (up to 1.5 miles down the canal, Table 7) in the Umatilla are excessive and should be reduced. Fishery agencies also recommend that screens placed in diversions should be angled to guide fish into the bypass. At present, Maxwell is the only site where screens are properly angled. Bypass systems also should provide for safe transport of fish back to the river. The open vertical slot design bypass is now considered the most efficient system, since fish can easily find the opening at all water depths. The round port bypass system, which is commonly used, requires that fish search to find the bypass opening at the bottom of the canal. On the Umatilla, West Extension and Maxwell are the only screening facilities with vertical slot bypasses (Table 7). Except for Dillon, the remaining facilities have either round port or gated bypasses. Dillon Canal lacks a fish bypass system. The screen on Dillon Canal is located approximately 15 feet down the canal. Fish that are diverted into the canal must swim back upstream to avoid getting washed onto the screen.

The concrete piers on multi-drum systems should be flush with the leading edge of the screens to allow for unobstructed lateral movement of fish into a bypass. Three of the multi-drum systems in the Umatilla (Stanfield - 3 drums; Cold Springs - 5 drums; Westland - 2 drums) are constructed with piers that are not flush with the screens. Although 8-10 inch portholes have been drilled in the piers, fish access to the bypass is probably obstructed, resulting in delay and possible mortality. The dual drum screen at Maxwell is constructed with piers that are flush with the screen.

There are 16 small ditches on the Umatilla and tributaries that lack fish screens. Generally less than 5 cfs are diverted at each of these ditches where temporary dikes are constructed across a portion of the river to divert water during April-September. It is likely that some juvenile steelhead are lost at these diversions. Survival of chinook from future releases could also be affected.

Correction of passage problems at the 16 unscreened diversion on the Umatilla River and Bitch Creek and Dillon and Brownell Screens have been given highest priority in the Northeast Oregon Screening Project (ODFW 1985a) funded by NMFS under the Columbia River Fisheries Development Program.

Tributary Stream

Stream Flow and Temperature

Most steelhead spawning and rearing in the basin is located in headwater tributaries. When established, it is anticipated that spring chinook will also use these tributaries for spawning and rearing. Headwater streams provide the most suitable flow and temperature conditions for rearing in the basin. Flows are low in these streams from the end of snowmelt in June until the start of the fall rains in October (Figure 14). An adequate supply of cool water in midsummer is critical for survival of juvenile steelhead during the 1 to 3 years they spend in headwater streams. Juvenile spring chinook also will rear in these streams at least one year before migrating to sea.

Riparian and Instream Habitat

The loss of riparian (streamside) habitat along the Umatilla tributaries contributes to poor stream conditions which limit fish production. Loss of riparian habitat has resulted in 1) greater seasonal variation in flow and water temperature, 2) unstable streambanks, 3) decrease in production of food organisms used by fish, and 4) loss of instream and streamside cover (FWS and NMFS 1982). Approximately 70% of the 422 stream miles inventoried on the

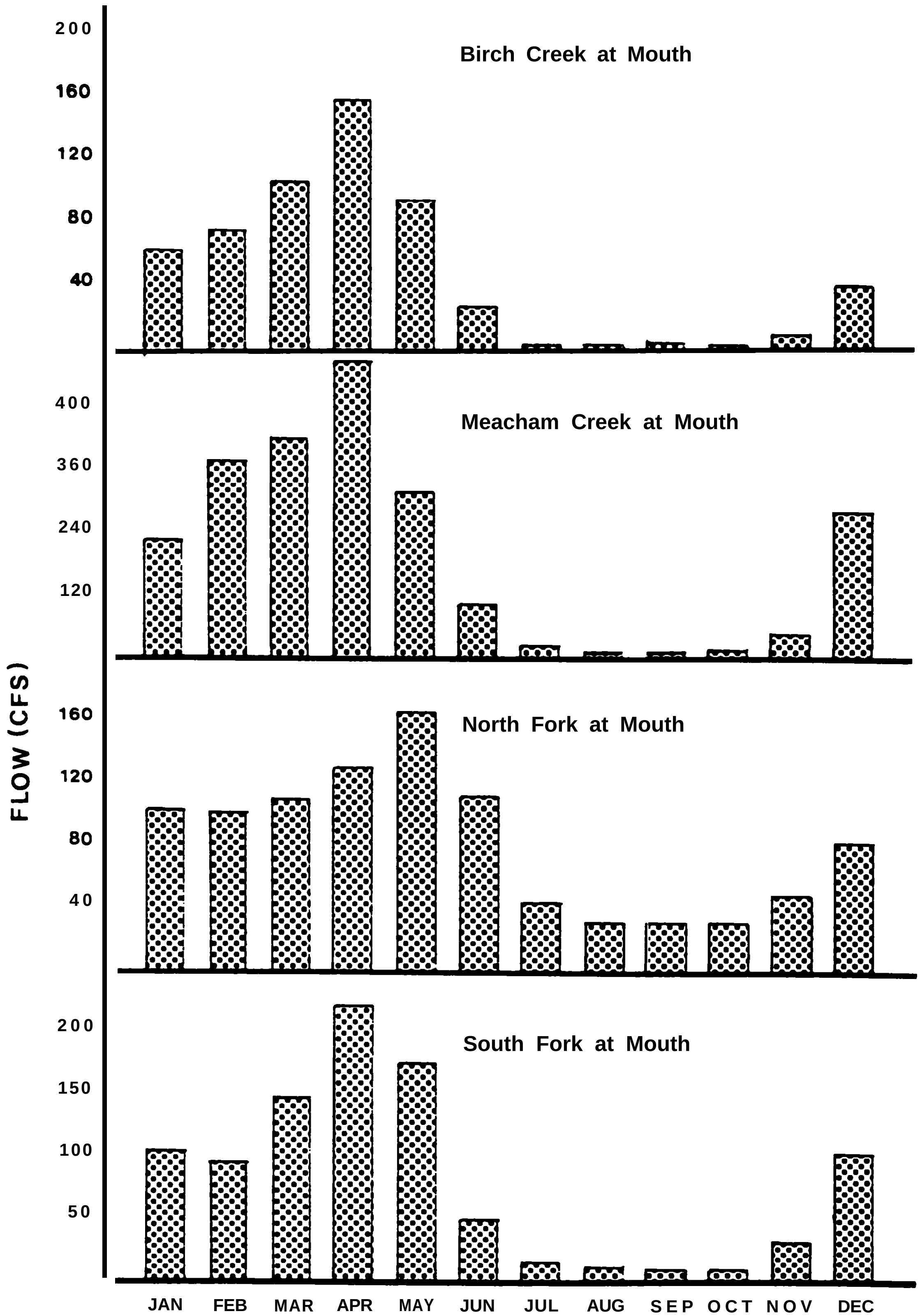


Figure 14. Average monthly flow[a/] in the four major tributaries in the Umatilla River Basin.

a/ USGS data compiled by BR (1983). Averages are for the years 1921-76 in Birch Creek, 1975-82 in Meacham Creek, 1967-81 in the North Fork, and 1968-81 in the South Fork.

Umatilla need riparian rehabilitation (FWS and NMFS 1982). Proposed habitat projects in the Umatilla drainage which have been submitted as proposed amendments to the Fish and Wildlife Program are listed in Table 16.

Intermittent or no summer flow in sections of Meacham, Squaw, Wildhorse, and Birch creeks is in part a result of extensive losses of riparian vegetation. A healthy riparian zone retains water from precipitation and gradually releases it to the stream during dry periods. In northeast Oregon streams, for example, the riparian zone is important in maintaining perennial flows during dry periods (FWS and NMFS 1981). Winegar (1977) and the FWS and NMFS (1981) have demonstrated that restoration of riparian vegetation to augment summer flow in northeast Oregon streams is a viable means of enhancing salmonid production.

Several factors have contributed to the degradation of riparian habitat in the Umatilla (CTUIR 1984). Farm practices and livestock overgrazing are probably the main causes but logging, road and railroad construction, and stream channelization have also affected riparian zones. An example of the effects of farming and grazing practices on riparian vegetation in Birch Creek is shown in Figure 15.

Lack of adequate pools in the Umatilla Basin also limits salmonid production. This condition exists in both small tributaries with steep gradient or large shallow tributaries that lack deep pools normally provided by boulders, fallen trees, or bedrock. Examples of streams in the basin with insufficient rearing pools are the North and South Forks of the Umatilla River and North and East Forks of Meacham Creek.

Figure 15. A reach of West Fork Birch Creek where streamside (riparian) vegetation is nearly absent (upper photo) and looking immediately downstream where farming and grazing practices have allowed riparian vegetation to flourish (lower photo). Photos are from Bureau of Reclamation.

Pools provide food, space, cover, and protection that are essential for rearing of salmonids. Pool area and volume have been found to be closely correlated with coho (Nickelson and Hafele 1978) and chinook (Bjornn et al. 1977) production. Pools also provide space, cover and protection for resting adults during their upstream migration.

Few habitat improvements have been made in the basin. In the early 1970's, the Forest Service placed 25 gabions and 50 boulders in the South Fork to improve summer rearing conditions for steelhead. Some of the gabions and boulders are still in place. In 1984, the Tribes placed 13 gabions in Squaw Creek which enters the Umatilla at RM 76.5.

Future Hydropower Development

There are three proposed hydropower projects which could negatively impact the fishery resources in the Umatilla Basin (NMFS 1984). The first two are at existing structures and have not been granted a license by the Federal Energy Regulatory Commission (FERC). The third proposal is a new diversion on the main stem Umatilla and has been granted a license by the FERC.

Three Mile Falls Dam Project

This project would use excess water that is spilled over Three Miles Dam and diverted into the irrigation canal. The main fisheries concern is use of the water spilled over the dam. As previously discussed, the channel below Three Mile Falls Dam is a major obstruction to the upstream passage of salmon. Even with upstream passage improvements, adult fall and spring chinook will have insufficient flows to reach Three Mile Falls Dam during some months of migration. Any reduction in water below Three Mile Falls Dam during adult upstream migrations threatens rehabilitation of these species. Other fishery concerns include winter operation of fish screens in the WEID Canal (icing could cause screens to operate improperly) and potential false attraction problems at the powerplant tailrace.

McKay Dam Project

There is a plan to operate a hydropower project utilizing the irrigation water released from McKay Dam during June-October. No fishery problems are anticipated providing that water release patterns are not altered and water quality standards are not lowered.

Boyd Project

The Boyd project has been granted a license by the FERC. The proposal is to construct a diversion near Hermiston and divert up to 500 cfs from the main stem Umatilla down a 5,300 ft power canal to a powerhouse. The proposed canal would utilize the remains of an old Pacific Power and Light Canal. No permanent diversion structure was included during the design and feasibility stages of the project but now a permanent weir has been proposed. Under provisions of the FERC license, a minimum of 150 cfs would be left in the main stem Umatilla during September-November to aid the upstream migration of fall chinook. However, under an agreement between ODFW, NMFS, and the licensee, a minimum of 200 cfs would be left in the same bypass reach September-November. Once spring chinook become reestablished, a 200 cfs minimum for the main stem will also be effective March-June. Stationary flat screens will be installed at the power canal entrance. Vertical slot openings of the screen will be 0.14" x 0.25" and approach velocity to the screen will be <0.5 ft/sec in accordance with screening criteria of the fish and wildlife agencies.

This project represents a new main stem diversion which will be the largest in the Umatilla Basin. There are four potential problems which could seriously impact the anadromous fishery resource, especially fall chinook:

1) The reduced flows could cause upstream passage problems for adults in the main stem below the diversion.

2) The diversion dam could create upstream passage problems. for adults.

3) The screen could cause downstream passage problems to juveniles, especially fall chinook fingerlings.

4) Future stream flows, either from existing or new storage, could be diverted unless the FERC reserves them from use at the project by amending the Boyd license.

Present and Proposed Flow Enhancement and Fishery Rehabilitation Projects and Costs

Project Descriptions

A listing of present and proposed flow enhancement and fishery rehabilitation projects is presented in Table 8. These are the "preferred" projects identified by the tribes and fish and wildlife agencies since they fully address tribal treaty reserved right to salmon and steelhead and are the best options available for achievement of natural and hatchery production goals established for the basin. The McKay Storage Plan is listed as an "interim" flow project to enhance flows until the Columbia River Pumping (CRP) or CRP/Meacham Dam Plans are completed. Trucking projects are also listed as interim since they would primarily be used to restore passage in the basin until the flow projects are implemented. Although trucking needs would be substantially reduced after implementation of flow projects, trapping/trucking will still be necessary during years of the low flow and to perform various mitigation operations in the basin.

A description of each project is given below. Because projects are in various stages of planning, some project descriptions are quite detailed (as BR's flow enhancement projects) while others are more general. We emphasize that all project designs and operations are preliminary and may change as final phases of planning are completed.

Table 8. Present and proposed flow enhancement and fishery rehabilitation projects in the Umatilla Basin.

Flow Enhancement Projects

Long Term Projects

1. Columbia River Pumping Plan
2. Columbia River Pumping/Meacham Dam Plan

Interim Project

1. McKay Storage Plan

Fishery Rehabilitation Projects

Long Term Projects

Upstream Passage Improvement

1. Lower Umatilla River channel modification
2. Three Mile Falls, Westland, Stanfield, Cold Springs, and Maxwell diversion dams.

Downstream Passage Improvement

1. West Extension, Westland, Stanfield, Cold Springs, Maxwell, Brownell and Dillon screen replacement.
2. Umatilla River and Birch Creek screen replacement/installation.

Habitat Improvement

1. Meacham, North Fork Meacham, Thomas, Squaw, Birch, East Fork Birch, West Fork Birch, Buckaroo, and Ryan creeks and North and South Fork and main stem Umatilla River instream rehabilitation.
2. Meacham, North Fork Meacham, Squaw, Birch, East Fork Birch, West Fork Birch, Buckaroo, and Ryan creeks and South Fork and main stem Umatilla River riparian protection/rehabilitation.

Hatchery Production

1. Hatchery facility for 200K summer steelhead.
2. Bonifer and Minthorn Springs adult collection/juvenile release facilities.
3. Fall and spring chinook and coho production.

Interim Project

Adult and Smolt Trapping/Trucking

1. Westland smolt trapping facility expansion.
2. Adult and smolt trucking program expansion.

Flow Enhancement Projects

As previously discussed, low stream flow due to naturally low flows and numerous irrigation diversions has been identified as the chief factor limiting production of anadromous salmonids in the Umatilla Basin. The Bureau of Reclamation has completed planning activities on a water development project which would provide higher flows in the main stem for fishery restoration. Higher main stem flows during adult upstream migration and spawning and juvenile rearing and downstream migration are essential to reestablishing and maintaining natural and hatchery production in the basin.

A comprehensive, long term solution to the basin's fishery problems will require inclusion of a flow improvement project as a core element. As will be shown, enhanced flows have a positive, synergistic effect on any fishery improvement project completed in the basin. Further, the Tribes have stated that for treaty reserved fishing rights to be realized, water must be made available to restore and maintain salmon and steelhead runs. The primary objective of the planning effort by the Bureau of Reclamation was therefore to develop a long term plan that would significantly improve Umatilla River flows. A description of the Bureau's recommended Columbia River Pumping (CRP) Plan and an alternative plan including the Columbia River Pumping concept and Meacham Creek storage (CRP/Meacham Dam Plan)[a/] follow.

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a/ In this report we refer only to the flow enhancement aspects of these projects. The CRP Plan as formulated by BR also includes adult fish passage improvements at Cold Springs, Westland, and Maxwell, construction of fish screens at Stanfield, Cold Springs, Westland, and Maxwell, and a 12 year post-project study to evaluate fishery restoration accomplishments. In addition to these projects, the CRP/Meacham Dam Plan includes instream and riparian habitat improvements in Meacham Creek.

CRP and CRP/Meacham Dam Plans

Plans for the Columbia River Pumping (CRP) (Recommended Plan) and CRP/Meacham Dam (Alternative Plan) flow enhancement projects were developed by the Bureau of Reclamation in conjunction with the Tribes and fish and wildlife agencies (BR 1985a). Flow enhancement projects for the Umatilla have been included in the Fish and Wildlife Program (FW Program Reference 704-d-2). The CRP Plan features a pumping plant located on the Columbia River that would lift water into Cold Springs Reservoir (Figures 16-17). A system of pumping plants and canals would subsequently lift water from Cold Springs Reservoir and convey it to Stanfield Irrigation District's canal system. This water would satisfy the Stanfield Irrigation District's demands and free part of their natural and McKay Reservoir storage water for anadromous fish in the Umatilla River.

The CRP Plan would allow Hermiston Irrigation District to delay diversion of water (Cold Springs Diversion) from the Umatilla River during times when flows become inadequate for fish passage (Table 9). Any water deficit resulting from the modified operation would be replaced in Cold Springs Reservoir by pumping from the Columbia River. If additional flows for fishery purposes are needed, there is an opportunity for a May, June, September, and October water exchange involving the West Extension Irrigation District. Water would be pumped from the Columbia River into the West Extension Canal allowing flow to remain in the river below Three Mile Falls Dam. Stream areas that would be affected by the CRP Plan include 6 miles of lower McKay Creek and 51 miles of the main stem Umatilla below the confluence of McKay Creek.

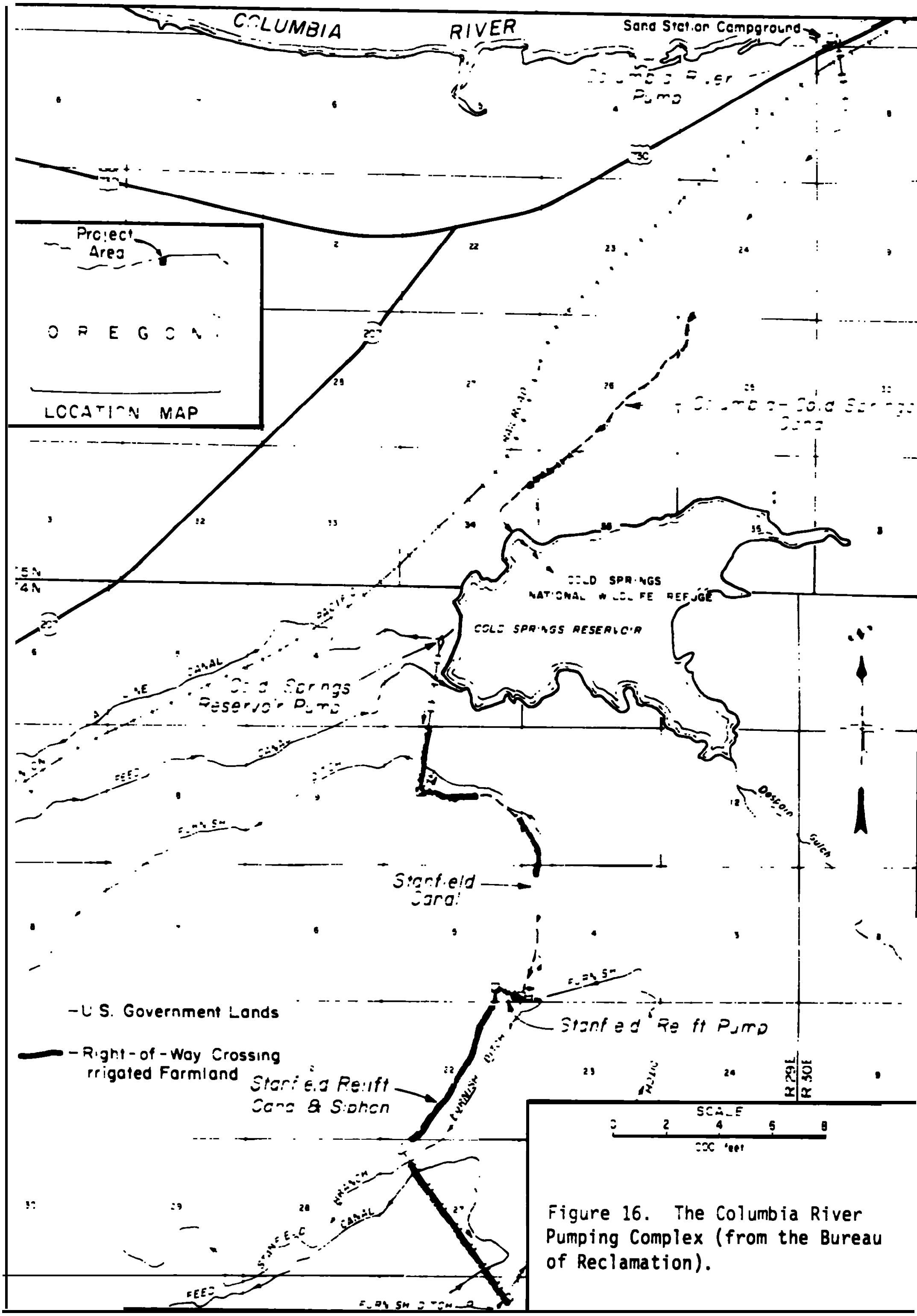

Figure 16. The Columbia River Pumping Complex (from the Bureau of Reclamation).

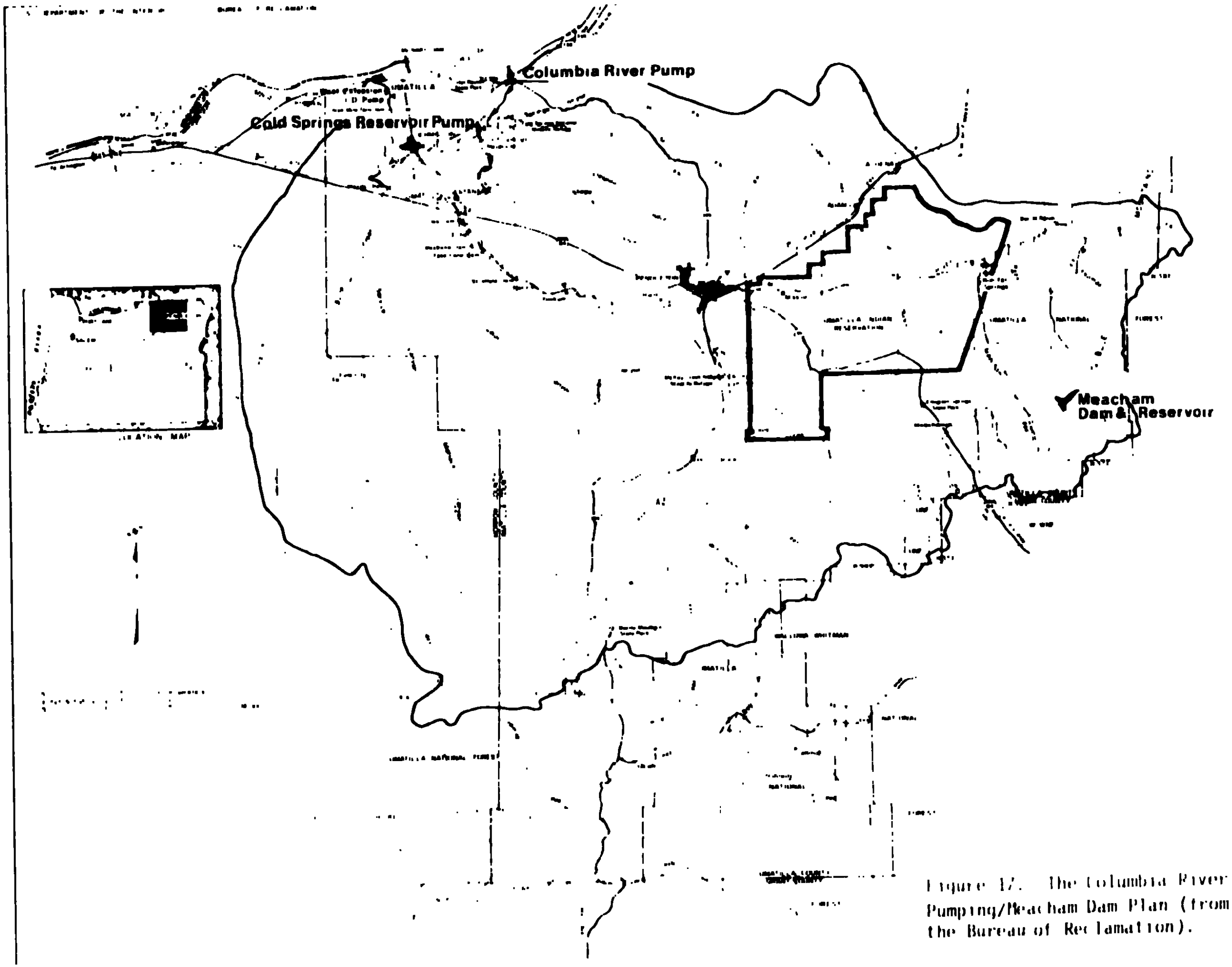

Figure 17. The Columbia River Pumping/Meacham Dam Plan (from the Bureau of Reclamation).

Table 9. **Operational plan of the Columbia River Pumping Plan (Recommended Plan) in the main stem Umatilla (from BR 1985a)**

Month	Recommended Minimum Flows[a]	Operational Procedures to Meet Recommended Minimum Flows
	cfs	
January	250	Flows provided by available natural flows plus Hermiston Irrigation District and County Line Improvement District diversion restrictions
February	250	
March	250	
April	250	
May	250	Flows provided through use of available natural flows plus Stanfield Irrigation District diversion restrictions. Fish migration to Three Mile Falls Diversion Dam during low flow periods improved by the use of the West Extension Irrigation District pump
June	250	
July	--	Minimum flows for anadromous fish not applicable
August	--	
September 1-15	--	
September 16-30	250	Flows provided by available natural flows plus McKay Reservoir storage releases
October	300	Flows provided by available natural flows, restrictions on Hermiston Irrigation District diversions and McKay Reservoir storage releases. Fish migration to Three Mile Falls Diversion Dam during low flow periods improved by the use of the West Extension Irrigation District pump
November 1-15	300	
November 16-30	250	Flows provided by available natural flows plus Hermiston Irrigation District and County Line Improvement District diversion restrictions
December	250	

a Minimum flows for Umatilla River from the confluence if McKay Creek downstream

Meacham Creek Dam would be located at Bear Creek on North Fork Meacham Creek (Figure 17). The dam would be 1,320 ft long with a crest height of 270 ft. The multi-level outlet would discharge directly into North Fork Meacham Creek.

With a capacity of 27,000 acre-feet, Meacham Reservoir would have a surface area of 264 acres at full pool and would extend approximately 2 miles up North Fork Meacham Creek and 1 mile up Bear Creek. Of the 27,000-acre-ft capacity, 24,300 acre-ft, would be available for project purposes.

Under the CRP/Meacham Dam Plan, Westland Irrigation District would exchange 3,600 acre-ft of its water in McKay Reservoir for 3,600 acre-ft in Meacham Reservoir. Westland Irrigation District's water in McKay would be released in Flay and June during years of low flow.

The CRP/Meacham Dam Plan was designed to meet flows of 250-300 cfs in the main stem Umatilla and 40 cfs in Meacham Creek (Table 10). These are the flows that were recommended by the Tribes and fish and wildlife agencies for ultimate production of anadromous salmonids in the basin. Flows would be increased during fall months (September 16-December 31) to aid the upstream migration of adult summer steelhead and fall chinook. During spring months (April 1 - June 30), flows would be increased to aid the upstream migration of adult spring chinook and the downstream migration of juvenile steelhead and chinook. Flows would be released from Meacham Reservoir during July 1 - September 30 to enhance rearing conditions for juvenile steelhead and spring chinook in Meacham Creek and during October 1 - November 30 to provide additional flows for migration of summer steelhead and fall chinook in the lower Umatilla. During low flow years, water would be released from the

Table 10. Operational plan of the Columbia River Pumping/Meacham Dam Plan (Alternative Plan) (from BR 1985a)

Month	Recommended Minimum Flows[a]	Operational Procedures to Meet Recommended Minimum Flows
	cfs	
---Main Stem Umatilla River---		
January	250	Flows provided by available natural flows plus Hermiston Irrigation District and County Line Improvement District diversion restrictions
February	250	
March	250	
April	250	
May	250	Flows provided through use of available natural flows plus Stanfield Irrigation District diversion restrictions. Dry year flows improved with use of 3,600 acre-feet of Westland Irrigation District McKay storage
June	250	
July	--	Flows for anadromous fish not applicable
August	--	
September 1-15	--	
September 16-30	250	Flows provided by available natural flows plus McKay Reservoir storage releases.
October	300	Flows provided by available natural flows, Hermiston Irrigation District diversion restrictions, plus storage releases prorated between McKay Reservoir and Meacham Reservoir
November 1-15	300	
November 16-30	250	Flows provided by available natural flows plus Hermiston Irrigation District diversion restrictions and Meacham Dam releases in dry years
December	250	
---Meacham Creek---		
July-October	40	Flows provided through available natural flows plus Meacham storage releases July through October
November- June	--	Minimum flows for anadromous fish not needed

a Minimum flows for (1) Umatilla River from the confluence of McKay Creek downstream and (2) Meacham Creek at its mouth.

reservoir in May and June to assist the upstream migration of adult spring chinook and downstream migration of juveniles. Projection of monthly flows and number and percentage of years out of 44 years that recommended flows would be met for the CRP and CRP/Meacham Dam Plans are summarized in Tables 11-12.

McKay Storage Plan

The BPA funded a study in 1983 to identify short term flow enhancement potential in the Umatilla Basin (Blakley Engineers, Inc.). Release of uncontracted water in McKay Reservoir was identified as one method to improve upstream passage of fall chinook during fall months. Approximately 8.4% (6,190 acre-feet) of the active storage in McKay Reservoir is currently uncontracted and may be available for purchase for fishery purposes. The quantity of water under existing long term contracts for water in McKay Reservoir and the capacity which could be marketed are as follows (unpublished data, BR):

	Acre-ft	Percentage
Total active capacity	73,800	100.0
Less capacity currently under long term contracts		
Stanfield Irrigation District	-25,830	-35.0
Westland Irrigation District	-29,520	-40.0
Individuals	- 6,260	- 8.5
Less reallocation to flood control, 1980	- 6,000	- 8.1
Uncontracted capacity	6,190	8.4

The average estimated annual yield of this uncontracted storage is 4,280 acre-ft. We assumed that this water would be released in October to improve upstream passage conditions for fall chinook. The release of 4,280 acre-ft in October would equal about 70 cfs/day for the 30 day period.

Table 11. Existing[a], enhanced[b], and recommended minimum[c] stream flows for fish life in the Umatilla River..

	Flow (cfs)											
	Oct	Nov[a]	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept[d]
Umatilla R at Umatilla Rm 2.1												
Existing	70	224	553	693	1345	954	1,095	549	108	23	26	35
CRP Plan	303	424	565	669	898	991	1,049	583	755	26	27	140
CRP/Meaham Dam Plan	319	440	521	633	849	940	991	574	284	32	38	167
Rec. Min.	300	300/250	250	250	250	250	250	250	250	120	85	85/250
Maxwell Diversion Rm 14.8												
Existing	65	158	494	627	769	954	1,167	576	120	49	50	49
CRP Plan	255	359	507	603	822	991	1,119	601	208	53	51	127
CRP/Meaham Dam Plan	313	375	463	567	773	940	1,069	601	296	58	62	176
Rec. Min.	300	300/250	250	250	250	250	350	250	750	120	85	85/250
Umatilla R at Echo Rm 27.3												
Existing	53	133	470	600	739	933	1,190	599	134	50	42	39
CRP Plan	243	333	482	575	792	970	1,142	624	223	54	43	117
CRP/Meaham Dam Plan	301	350	438	539	743	919	1,092	625	310		54	167
Rec. Min.	300	300/250	250	250	250	250	250	250	250	120	85	85/250
Cold Springs Diversion Rm 29.2												
Existing	80	153	508	641	777	979	1,372	799	330	251	218	124
CRP Plan	258	347	519	613	835	1,021	1,341	878	419	254	719	202
CRP/Meaham Dam Plan	317	364	475	576	786	970	1,292	828	506	260	230	252
Rec. Min.	300	300/250	250	250	250	250	250	250	250	120	85	85/250
Stanfield Diversion Rm 32.3												
Existing	89	261	664	781	943	1,158	1,547	962	381	250	216	122
CRP Plan	256	346	665	782	944	1,159	1,548	984	424	252	217	200
CRP/Meaham Dam Plan	311	362	621	746	895	1,107	1,498	985	510	257	228	250
Rec. Min.	300	300/250	250	250	250	250	250	250	250	120	85	85/250
Umatilla R at Yoakum Rm 37.7												
Existing	86	259	662	779	941	1,166	1,634	1,073	494	367	320	164
CRP Plan	253	343	663	780	942	1,167	1,635	1,072	446	249	210	195
CRP/Meaham Dam Plan	311	360	619	743	893	1,116	1,585	1,073	532	254	222	245
Rec. Min.	300	300/250	250	250	250	250	250	250	250	120	85	85/250

(continued next page)

Table 11. (continued)

	Flow (cfs)											
	Oct	Nov[d]	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept[d]
Birch Creek at Mouth												
Existing	4	15	43	66	77	107	159	97	28	2	0.3	0.7
Rec. Min.	8	8	20	20	30	30	30	30	20	15	8	8
Umatilla R at Pendleton Rm 55.1												
existing	74	239	589	672	801	989	1,325	866	316	74	37	44
CRP/Meacham Cr. Plan	143	262	546	636	754	939	1,278	863	367	102	67	79
Rec. Min.	60	200	200	200	240	240	240	240	200	100	60	60
Umatilla R at Mission Rm 60.0												
Existing	69	221	524	568	687	848	1,185	801	294	70	40	43
CRP/Meacham Cr. Plan	138	243	480	532	639	796	1,136	796	344	96	70	77
Rec. Min.	60	200	200	200	240	240	240	740	200	100	60	60
Meacham Cr. at Mouth												
Existing	17	46	284	216	377	407	583	327	110	26	14	13
CRP/Meacham Cr. Plan	86	86	108	184	181	247	315	472	292	40	40	43
Rec. Min.	25	75	80	80	120	120	120	170	80	50	25	25
Umatilla R. above Meacham Cr. Rm 83.1												
Existing	60	207	250	268	300	365	547	459	202	67	48	48
Rec. Min.	25	25	60	60	97	97	97	97	60	40	40	40
North Fork at Mouth												
Existing	34	49	83	103	102	111	130	166	109	42	33	33
Rec. Min.	12	12	25	25	40	40	40	40	25	25	25	25
South Fork at Mouth												
Existing	11	35	107	106	98	147	319	180	51	14	Y	9
Rec. Min.	15	15	30	30	58	58	58	58	30	30	30	30

a USGS data compiled by BR (1983). All were 40-50 year averages except Meacham Creek (8 year) and the North and South Forks (14-15 year).
b Flows provided by BR's CRP and CRP/Meacham Dam Plans.
c Established by the tribes and fish and wildlife agencies (BR 1985).
d Values given fur the first and second half of the month.

Table 12. Number and percentage of years out of 44 years that recommended minimum flows would be met under existing flows and enhanced flows of the CRP and the CRP/Meacham Dam Plans (from BR 1985a).

	Umatilla Gage (Rm 2.1)						Echo Gage (Rm 27.0)					
	Existing Flows		CRP		CRP/Meacham		Existing Flows		CRP		CRP/Meacham	
	No. Years	%	No. Years	%	No. Years	%	No. Years	%	No. Years	%	No. Years	%
January	33/44	75	41/44	93	41/44	93	26/44	59	36/44	82	37/44	84
February	37/44	84	43/44	98	43/44	98	33/44	75	42/44	95	43/44	98
March	38/44	86	44/44	100	44/44	100	38/44	86	44/44	100	43/44	98
April	40/44	91	41/44	93	41/44	93	41/44	93	41/44	93	42/44	95
May	28/44	64	38/44	86	38/44	86	28/44	64	38/44	86	43/44	98
June	6/44	14	22/40	50	37/44	84	7/44	16	15/44	34	37/44	84
July	--a/		--a/		--a/		--a/		--a/		--a/	
August	--a/		--a/		--a/		--a/		--a/		--a/	
September 1-15	--a/		-a/		--a/		--a/		--a/		--a/	
September 16-30	0/44	0	31/44	70	42/44	95	0/44	0	5/44	11	43/44	98
October	1/44	2	30/44	68	37/44	84	0/44	0	7/44	16	38/44	86
November 1-15	3/44	7	37/44	84	41/44	93	2/44	5	21/44	48	38/44	86
November 16-30	18/44	41	30/44	68	39/44	89	13/44	30	21/44	48	38/44	86
December	27/44	61	36/44	82	36/44	82	24/44	55	34/44	77	35/44	80

[a]/ Minimum flows for anadromous fish not provided.

Fishery Rehabilitation Projects

1. Upstream Passage Improvement

Lower Umatilla River Channel Modification

The BPA contracted with the Corps as part of the Fish and Wildlife Program (FW Program Reference 704-d-1) to modify the stream channel below Three Mile Falls Dam to improve upstream passage condition for adult steelhead and chinook. In 1984, a 10 ft wide, 5 ft deep channel was created in bedrock areas from 1,000 ft below Three Mile Falls Dam to Chinaman's Hole (Rm 1.3) (Figure 9). A total of 3,380 lineal ft of bedrock was modified in this 2 mile reach below the dam. Some of the proposed channel modifications were not completed in 1984, and other modifications did not meet contract specifications and require additional channel work. The USACE will submit a proposal to BPA to complete all channel work during 1986.

Three Mile Falls, Westland, Stanfield, Cold Springs, and Maxwell Diversion Dam Improvements.

Preliminary plans to improve juvenile and adult passage at Three Mile Falls Dam has been developed by the Bureau of Reclamation in cooperation with the Tribes and fish and wildlife agencies (BR 1985b). Funds have been provided by BPA under the Fish and Wildlife Program (FW Program Reference 704-d-1). A committee comprised of representatives from each cooperating agency was formed in 1984 to identify alternatives for solving passage problems at the dam. Eight potential actions were identified (see FWS 1984) and a single alternative was selected early this year.

The main features of this alternative would be the construction of a new east bank ladder, modification of the existing west bank ladder, and installation of rotary drum screens and related structures in the WEID Canal. The design and operation of facilities (BR 1985b) are discussed below. These plans are preliminary and may change during subsequent stages of plannng.

1. <u>Description of Facilities</u>

<u>East Bank Ladder</u>

The new ladder (to be located just west of existing ladder) will be a vertical slot design with a 15 inch slot opening and a 10:1 floor. Ten 8 ft by 10 ft pools will be required. An entrance pool and channel will be excavated and gates will be installed to facilitate access to the ladder. Auxilliary water to the entrance structure will be supplied by an overflow gate. The exit structure will have a viewing station for viewing and counting. A retaining wall will extend upstream to help maintain an open exit channel. Adults will be trapped as they pass through the exit channel just beyond the viewing station. Adults will be diverted into a specific holding pool by a set of hydraulically operated slide gates and moved into a portable tank by a power crowder. The tank will then be lifted by an elevator high enough to sluice fish into fish transport trucks. Grating over the structure and chain link fence with barb wire top will be installed to prevent poaching and vandalism.

West Bank Ladder

The west bank ladder modifications, will include a new entrance structure, improved auxilliary water flows, and an adult viewing, counting, and trapping station. The vertical slot ladder would not be changed since it meets state-of-the-art design criteria of the fish and wildlife agencies.

Modifications include removal of the top of one of the arch buttresses, removal of the old auxilliary water supply and existing bypass pipe, and renovation of much of the existing entrance and exit. Trash racks will be required across the exit to the fishway and at the entrance to the auxilliary water supply and new trash racks will replace existing ones across the canal entrance. The trapping facility is similar in design and operation as the one on the east bank ladder. However, because trucks will not be able to park adjacent to the facility, a long sluice system will transfer fish from the elevated portable tanks to the trucks at a location just downstream of the gatehouse. Grating will be installed but no additional chain link fence is required since access is limited by existing locked gates.

WEID Canal Fish Screens

The new screen and bypass facility will be designed to comply with screening criteria of the fish and wildlife agencies. The screen structure will be located on the WEID Canal just downstream of the gate-house. The existing louver screens will be removed and seven 10 ft diameter 12.5 ft long rotary drum screens will be installed, oriented at a 25° angle to the canal flow. The screens will be designed to accommodate 310 cfs (the design capacity of the canal), however since actual use averages only 210 cfs and the existing capacity is 270 cfs due to settling of the canal, a lower design flow may be chosen prior to final design.

The bypass will be vertical slot design and will include a pump-back system to return a large portion of the bypass water to the canal. A juvenile trap will be installed between the bypass and the Umatilla River.

2. Operation Plan

The ladders will be designed to operate ideally at 85 cfs which will provide the desired fish attraction velocities through the entrance gates. Approximately 45-60 cfs will be provided by the ladder and the remaining flow from the auxilliary water supply system. The ladders will be designed to operate at flows up to 6000 cfs. During low flows over the crest (when there is insufficient flows to operate both ladders

Satisfactorily and the spill over the crest causes fish to be attracted to the east 1 adder), only the east bank ladder will be operational. If there is no flow over the crest, only the west bank ladder will be operational.

The fish screen will handle 310 cfs, however as mentioned above, actual use averages only 210 cfs. The bypass will take 65 cfs and the pump-back system will be capable of pumping 62 cfs back into the canal if needed. Only 4-5 cfs will be required to operate the trap and to return juveniles to the river. However, additional water from the dam or ladders will be required to provide safe passage of juveniles downstream.

Silt removal from the exit channel and debris removal from the dam crest and exit, entrance, and immediate channels downstream are essential maintenance tasks necessary to keep the fish ladders operational.

Passage improvement projects for the Umatilla have been included in the Fish and Wildlife Program (FW Program Reference 704-d-1) but formal planning at Westland, Stanfield, Cola Springs, and Maxwell diversion dams has not been initiated. No field data have been collected and no site-specific layouts have been made. However, for purposes of this plan, ODFW has developed preliminary designs for improving adult passage at Westland, Stanfield, Cold Springs, and Maxwell diversion dams. These improvements include construction of ladders at each dam (Table 13). Standard ODFW designs were used to determine pools per ladder, drop between pools, dimensions of pools, and pool slot widths.

Ownership, operation, and maintenance responsibilities of each diversion dam are listed in Table 14.

Table 13. Preliminary designs of fish ladders proposed for Westland, Stanfield, Cold Springs, and Maxwell diversion dams (from ODFW).

Diversion	Number of 1 adders	Location of ladders	Pools a/ per Ladder	Pool Dimensions (ft.) Length	Width	Pool Slot Width (in.)
Westland	2	E. and W. banks	6	8	6	12
Stanfield	1	E. bank	6	8	6	12
Cold Springs	1	E. bank	2	10	8	15
Maxwell	1	E. bank	2	10	8	15

[a]/ Ladders will have a 1 foot maximum drop between pools at forebay and tailwater levels.

b/ A 12 inch high sill will be considered for the bottom of the slot to maintain an adequate pool depth at low flows.

2. Downstream Passage Improvements

Replace West Extension, Westland, Stanfield, Cold Springs, Maxwell, Brownell. and Dillon screens

Passage improvements at screened and unscreened diversions for the Umatilla are included in the Fish and Wildlife Program (FW Program Reference 704-d-1). Preliminary designs to replace screens and bypass facilities at the five large diversions on the main stem (West Extension, Westland, Stanfield, Cold Springs, and Maxwell) have been proposed by the Bureau of Reclamation. A new structure will be constructed at West Extension to replace the louvre system (BR

Table 14. Ownership, operation, and maintenance responsibilities of screened diversions in the Umatilla drainage.

	Rm	Dam	Screen
Stanfield (Furnish Canal)	32.3	Stanfield Irrigation District (ownership, operation and maintenance)	Stanfield Irrigation District (ownership, operation, and maintenance)
Cold Springs (Feed canal)	29.2	Bureau of Reclamation (ownership)	Fish and Wildlife Service (ownership, operation, and maintenance)
		Hermiston Irrigation District (operation and maintenance)	
Westland	27.3	Westland Irrigation District (ownership, operation, and maintenance)	Westland Irrigation District (ownership, operation, and maintenance)
Dillon	24.7	Dillon Ditch Company (ownership, operation, and maintenance)	Dillon Ditch Company (ownership, operation, and maintenance
Maxwell	14.8	Bureau of Reclamation (ownership)	Hermiston Irrigation District (ownership, operation, and maintenance)
		Hermiston Irrigation District (operation and maintenance)	
West Extension	3.0	Bureau of Reclamation (ownership)	West Extension Irrig. District (ownership, operation, and maintenance)
		West Extension Irrigation District (operation and maintenance)	
Brownell	1.0	Brownell Irrigation Company (ownership, operation, and maintenance)	Brownell Irrigation Company (ownership, operation, and maintenance) maintenance)

1985 b). New structures will be constructed at Westland, Stanfield, Cold Springs, and Maxwell screens and will be located as near to the headworks as possible. All structures would be designed to meet the criteria necessary for safe passage of fry (<60 mm length) at all flows:

1. Approach velocity - 0.5 cfs maximum (at the screen surface) with a sweeping component along the face of the screen toward the bypass of at least twice the velocity of water moving through the screen.
2. Angle of screen to canal flow - 25°.
3. Screen mesh opening - 1/8" maximum.
4. Open vertical slot design bypass 1/2 to 1 ft wide to provide 4 cfs minimum in the bypass.
5. Bypass operable over a wide range of river flows.
6. Normal water depth 3/4 of screen diameter.
7. Supporting piers as nearly flush with the face of the screens as possible.

Improvements at each site will also include a trash rack, an overflow wasteway, and a permanent storage and lifting mechanism. Westland, Stanfield, Cold Springs, and Maxwell sites will be fenced and small storage buildings will be constructed.

Bureau of Reclamation design estimates for the West Extension, Westland, Stanfield, Cold Springs, and Maxwell screens were based on meeting the above criteria. No field data were collected and no site-specific layouts were made. We assumed 6 ft wide and 10 ft long rotary drum screens would be used at Westland, Stanfield, Cold Springs, and Maxwell and 10 ft wide and 12.5 ft long rotary drum screens would be used at West Extension. The number of screens required at each site was determined by the size of the canal (diversion capacity). The diversion capacity at each site and number of screens needed to meet approach velocity criteria are listed below.

	Diversion Capacity (cfs)	No. Screens
West Extension	310	7
Westland	240	11
Stanfield	150	7
Cold Springs	240	11
Maxwell	90	4

The Oregon Department of Fish and Wildlife has provided preliminary plans for replacement and installation of screens and bypass facilities on small diversions on the Umatilla River and Birch Creek. During the summer of 1984, ODFW made on-site determinations of the screen size that would be required at each diversion (Table 15). Brownell and Dillon screens and bypasses will be replaced. New screens will be installed on 16 unscreened diversions on the Umatilla River and Birch Creek. All screens and bypasses will be designed and installed to meet criteria established by the fish and wildlife agencies for passage of fry. A single rotary drum screen will be installed on each diversion.

Table 15. Preliminary screen sizings for small diversions in the Umatilla drainage (ODFW 1985a).

Diversion	Rm	Required Screen Size (width x length) in inches
Umatilla River		
Brownell Ditch[a]	1.0	24 x 96
Dillon Canal[a]	24.7	30 x 96
Wilson Ditch	29.0	24 x 96
(2 ditches)		24 x 84
Cunha Ditch	30.0	24 x 96
Brown's Ditch	47.0	24 x 84
Wyss Ditch	50.8	30 x 96
Crispin Ditch	57.0	24 x 60
Birch Creek		
Johns, Smith, Beamer Canal	0.3	24 x 84
Kuhn Ditch	2.8	14 x 36
Straughan Ditch	4.8	14 x36
Elridge and Hummel	10.2	18 x 36
Gambell Ditch	14.5	18 x 60
L. P. Ditch	16.0	30 x 96
E. Fork Birch Creek		
Sherrill Ditch	2.1	24 x 60
Cortazar Ditch	7.2	18 x 48
W. Fork Birch Creek		
Hutchinson Ditch	1.0	18 x 36
Cunningham Ditch	2.5	18 x48

[a] Replacement - all others are new installations.

Ownership, operation, and maintenance responsibilities of screened diversions are listed in Table 14. Ownership, location, and diversion specifications of unscreened diversions in the drainage appear in Appendix B.

3. Habitat Improvement

Habitat improvements proposed by CTUIR, USFS, and ODFW for the basin are summarized in order of priority in Table 16. Habitat projects for the Umatilla are included in the Fish and Wildlife Program (FW Program Reference 704-d-1). Habitat improvements would involve 1) instream rehabilitation including placement of boulders and rock deflectors, installation of weirs, pool excavation, and channel restoration, and 2) riparian protection and bank stabilization. Basinwide, riparian protection and bank stabilization would involve a total of 130 and 44.5 miles, respectively. A total of 18,630 boulders and 1,966 other structures would be placed in upper tributary and main stem areas.

4. Adult and Smolt Trapping/Trucking

Adult and smolt trapping and trucking projects are included in the Fish and Wildlife Program to restore passage in the basin (FW Program Reference 704-d-1). These projects serve to:

1) Restore passage in the basin until the flow enhancement projects are implemented. Flow enhancement is the only acceptable means to achieve long term Tribal and fishery goals in the Umatilla.

Table 16. Habitat improvements proposed for the Umatilla Basin in Priority Order (from CTUIR 1984). Actual improvements may vary after on the ground project planning occurs.

Stream	Species[a]/	Priority[b]/	Stream Miles Needing Work				Mi. Riparian Impvmt.		No. Instr. Struct.		Type of Work or Struct[f]/
			CTUIR[c]/	USFS	Private	Total	Protect[d]/	Bk. Stab.[e]/	Boulders	Other	
Meacham Creek	ChS, StS	1	5.5	2.5	7.0	15.0	20.0	12.0	2,250	160	BDPC
North Fork Meacham Creek	StS	1	0.0	0.0	3.0	3.0	6.0	0.2	300	30	BDW
South Fork Umatilla River	ChS, StS	2	0.0	5.0	0.0	5.0	0.0	0.2	550	318	BDW[g]/
Thomas Creek	StS	2	0.0	5.0	0.0	5.0	0.0	0.0	200	200	BDW
Mainstem Umatilla River (Meacham Creek to Forks)	ChS, StS	3	3.0	1.3	6.7	11.0	0.0	3.0	2,200	110	BDC
North Fork Umatilla River	ChS, StS	4	0.0	4.0	0.0	4.0	0.0	0.0	400	40	BDW
Squaw Creek	StS	5	10.0	0.0	0.0	10.0	16.0	8.0	1,000	100	BDW
Birch Creek	StS	6	0.0	0.0	17.0	17.0	27.0	2.0	1,700	170	BDW
East Fork Birch Creek	StS	6	0.0	4.0	13.0	17.0	12.0	2.5	1,700	170	BDW
West Fork Birch Creek	StS	6	0.0	0.0	26.0	26.0	46.0	4.5	2,600	260	BDW
Buckaroo Creek	StS		6.0	0.0	0.0	6.0	12.0	0.0	600	60	BDW
Ryan Creek	StS	8	0.0	3.1	1.5	4.6	4.0	0.1	460	93	BDW
Mainstem Umatilla River (Pendleton to Meacham Creek)	StS	9	23.0	0.0	0.0	23.0	5.0	12.0	4,600	230	BDC
Spring Creek	StS	10	0.0	0.7	0.0	0.7	0.0	0.0	70	14	BDW
Shimmihorn Creek	StS	10	0.0	1.1	0.0	1.1	0.0	0.0	0	11	WD
TOTALS			47.5	26.7	74.2	148.4	130.0	44.5	18,630	1,966	

a/ ChS indicates potential spring chinook habitat; StS indicates potential summer steelhead habitat.
b/ Priorities based on potential for increased fish production.
c/ Refers to stream miles inside the existing reservation boundary. Some areas in the reservation are privately owned.
d/ Refers to permanent or temporary riparian corridor fencing, riparian pasture systems, or livestock exclusion.
e/ Bank stabilization refers to planting, rip-rapping, or placement of deflector structures.
f/ Structure types are: W = Weirs; B = Boulder placement; D = Rock deflectors; P = Pool excavation; C = Channel restoration.
g/ Some work will include upgrading of old gabions with rip-rap covering.

However, trapping and trucking projects can be implemented quickly and can be used as an interim measure to restore passage until flows are improved.

2) Provide passage during years of low flow. Even with enhanced flows, flows will be inadequate during all months of migration during droughts.

3) Provide collection and transportation for hatchery supplementation/ reintroduction projects.

4) Increase management and research options. Adult trapping capability at Three Mile Falls Dam allows for terminal harvest at the dam. Adult and smolt trapping capabilities at Three Mile Falls and the juvenile trapping facility at Westland allow for collection of adults and juveniles for research and evaluation.

Preliminary plans to install juvenile and adult trapping facilities at Three Mile Falls Dam have been developed by BR as part of their Three Mile Falls Dam Passage Improvement Project (BR 1985b). Adult trapping facilities at both ladders will include a holding pool, a power crowder, and an elevator to load fish into trucks.

Initial plans to expand the smolt trapping facility at Westland and the adult and smolt trucking program were developed by ODFW. The project at Westland will involve construction of a new concrete holding pool for 100,000 fingerlings (80/lb) or 10,000 smolts (5/lb). These numbers coincide with the estimated maximum number of juveniles which will arrive at the trap in a single day when ultimate production in the basin is achieved.

The holding pool will be 2,600 ft^3 (65 ft long, 10 ft wide, and 4 ft deep) and water will be supplied at 300 gallons/minute. The facility will be designed so that fish can be trapped, loaded, and hauled by 1 person. Fish will be concentrated with a power crowder. A 6 inch fish pump will be used to load fish into trucks for transport to the Columbia River.

Fish hauling equipment and additional manpower will be provided for the adult and smolt trucking program. The existing 365 gallon fish tank and trailer must be replaced and a new 2500 gallon fish truck will be needed to haul future numbers of adults and smolts produced in the basin. The 365 gallon unit will be used to: 1) haul smolts from the Westland trap to the Columbia River, and 2) haul small numbers of adults from the Three Mile Falls Dam trap to Bonifer and Minthorn Springs adult collection/juvenile release facilities and to the upper Umatilla. The 2500 gallon unit will be used to 1) haul smolts from Bonneville (and eventually the Umatilla River Summer Steelhead Hatchery) to Bonifer and Minthorn Springs and other areas in the upper Umatilla, 2) haul smolts from Westland to the Columbia River during peak downstream migrations, and 3) haul adults from Three Mile Falls Dam to Bonifer and Minthorn and the upper Umatilla. Fish hauling capacity of the 365 gallon unit is 24,000 fingerlings (80/lb), 1800 smolts (5/lb), or 42 adults (10 lb/fish) compared to 160,000 fingerlings, 12,000 smolts, or 280 adults of the 2500 gallon unit.

The tank on the 365 gallon unit will be stainless steel and will have 1 compartment. It will be mounted on a tandem axle trailer to be hauled with a 3/4 ton pickup. The unit will be equipped with a recirculation and oxygen system. The 2500 gallon unit will be similar in design to the fish truck recently purchased by ODFW for Willamette River hatcheries. The 4-compartment stainless steel tank will be moved on a diesel powered truck. The unit will have a refrigeration system, an oxygen system, a replacement main motor pump, and an auxiliary pump to provide for safe transport of fish.

5. Hatchery Production

Hatchery production projects include construction of a hatchery for 200,000 summer steelhead, construction of adult collection/juvenile release facilities at Bonifer and Minthorn Springs, and fall and spring chinook and coho reintroduction and broodstock development programs.

Hatchery Facility for 200k Summer Steelhead

Ultimately, 200,000 summer steelhead smolts will be released in the basin to achieve natural and hatchery production rehabilitation objectives. These smolts will be reared in a new hatchery planned for near Irrigon. Funds will be provided by BPA under the Fish and Wildlife Program (FW Program Reference 704-i-l). The hatchery will be an offsite facility to support Bonifer and Minthorn Springs facilities. Preliminary site investigations were completed in early 1985 (ODFW 1985b). A technical committee was formed to develop final design of the hatchery. Tentative completion dates are 1986 for preliminary design, 1987 for final design, 1988 for construction, and 1988 for start of evaluation.

Bonifer and Minthorn Springs Adult Collection/Juvenile Release Facilities

The Bonifer Springs adult collection/juvenile release facility was constructed on lower Meacham Creek (Rm 2) in the fall of 1983. The facility was funded by BPA under the Fish and Wildlife program (FW Program Reference 704 i-l). Union Pacific Railroad contributed access and built a bridge to the site. The facility consists of a 2 acre pond (maximum depth = 6 to 8 ft) and an adult fishway. Under a cooperative agreement between CTUIR and ODFW, ODFW will supply approximately 50,000 native juvenile steelhead (near smolt) for the facility for 3 years beginning in 1984. Summer steelhead smolts were first released into Bonifer in 1984 (58,000) and fall chinook upper river bright yearlings were released into Bonifer in 1983 (20,000) and 1984 (50,000).

Construction of the Minthorn Springs facility on the main stem Umatilla (Rm 64) was completed in the fall 1985. All funds have been and will be supplied by BPA under the Fish and Wildlife Program (FW Program Reference 704 i-l). The facility consists of two 120 ft long, 12 ft wide, and 3 ft deep concrete juvenile holding ponds, a 26 ft long, 8 ft wide, and 3 ft deep adult holding Pond, and an adult fishway.

Eventually all smolts will be released into the Bonifer and Minthorn Springs ponds for a 2-4 week acclimation period. This acclimation period is anticipated to increase survival of smolts and increase homing of adults to the Umatilla.

Until greater flows are provided by the flow enhancement projects, broodstock will primarily be collected at Three Mile Falls Dam. Some broodstock collection may continue at Three Mile Falls Dam as a method to maintain genetic variability. Future adult returns to the facilities in excess of broodstock needs will be used for supplementation and reintroduction of natural populations.

Fall and Spring Chinook and Coho Reintroduction and Broodstock Development

To assist in restoring fall chinook in the Umatilla River, ODFW has redirected release of part of the John Day mitigation fall chinook to the Umatilla River. Eventually, however, rehabilitation of fall chinook must be accomplished with adults that are additional to returns resulting from John Day mitigation (see discussion in Rehabilitation Plan section). Approximately 225,000 yearling upper river bright fall chinook have been scheduled for annual release into the Umatilla in the next several years to expedite broodstock development. Rearing will most likely continue at the Bonneville Hatchery. Broodstock will be collected at Three Mile Falls Dam or at Bonifer and Minthorn Springs.

Spring chinook and coho have yet to be reintroduced, but the first release of spring chinook (Carson stock) will be made in 1986. Production of hatchery spring chinook and coho for the Umatilla may be determined in part by the results of the ongoing U.S. vs. Oregon negotiations.

Costs

Preliminary capital/construction and annual operation/maintenance costs for flow enhancement and fishery rehabilitation projects are presented in Tables 17-20. These cost estimates are preliminary and may change as final designs and operational schedules are completed. Costs in Table 17 are provided for the five categories of projects evaluated in this report: flow enhancement, upstream passage improvement, downstream passage improvement, adult and smolt trapping/trucking, and habitat improvement. No costs are provided for the McKay Storage flow enhancement project since cost of the 6,000 acre-ft in McKay Reservoir depends on the contract negotiated with BR and the irrigation districts.

Operation/maintenance costs of adult and smolt trapping/trucking will vary with flow. At ultimate production, estimated annual operation/maintenance costs would be $46,002 under existing and $28,593 under enhanced flows provided by the CRP or CRP/Meacham Dam Plans. This savings would result from reduced hauling of smolts from Westland and adults from Three Mile Falls Dam.

Approximately $1.67 million has been spent on salmon and steelhead restoration in the Umatilla since 1980. This includes $960,000 for construction of Bonifer and Minthorn facilities and passage improvements in the lower Umatilla channel, $150,000 for evaluation of passage improvements in the lower Umatilla

Table 17. Preliminary cost estimates for flow enhancement and fishery rehabilitation projects proposed in the Umatilla Basin. Costs are not included for projects which have been completed or the Umatilla Summer Steelhead Hatchery and the McKay Storage Plan project.

Flow Enhancement Projects (1983 prices)	Construction/Capital costs (dollars)	Annual Operation/ Maintenance Costs (dollars)
Columbia River Pumping Plan	$ 33,234,000	$253,900[a]/
Columbia River Pumping/ Meacham Dam Plan	$125,461,000	$218,600[a]/
Fishery Rehabilitation Projects		
Upstream Passage Improvement (1984 and 1985 prices)		
Three Mile Falls Diversion Dam	b 1,680,000	$ 50,000
Westland Diversion Dam	216,000	2,000
Stanfield Diversion Dam	75,000	1,000
Cold Springs Diversion Dam	24,000	1,000
Maxwell Diversion Dam	24,000	1,000
TOTAL	$ 2,019,000	$ 55,000
Downstream Passage Improvement (1984 and 1985 prices)		
Large Diversions		
West Extension Screen	$ 1,830,000	$ 22,000
Westland Screen	1,000,000	20,000
Stanfield Screen	670,000	10,600
Cold Springs Screen	1,000,000	25,000
Maxwell Screen	420,000	7,400
TOTAL	$ 4,920,000	B 85,000
Small Diversions (1984 prices)		
Brownell Screen	$ 3,500	$ 130
Dillon Screen	4,600	130
Umatilla River and Birch Creek Unscreened Diversions (16 diversions)	47,600	2,080
TOTAL	B 55,700	$ 2,340

Table 17. (cont.)

	Construction/Capital Costs (dollars)	Annual Operation/ Maintenance Costs (dollars)
Adult and Smolt Trapping/Trucking (1984 prices)		
2,500 gallon fish truck	$ 130,000	$ 14,100 (11,844)[b]
365 gallon tank, trailer, and truck	22,000	2,400 (1,248)
Westland Smolt Trap Expansion	53,500	2,000 (2,000)
Power Crowder	50,000	5,000 (5,000)
Fish Pump	15,000	1,500 (1,500)
Labor (EBA-1)		21,002 (7,001)
TOTAL	$ 270,500	$ 46,002 (28,593)
Habitat Improvement (1983 prices)		
Meacham Creek and N. Fork Meacham Creek	$ 426,750	$ 3,800
N. and S. Fork Umatilla River	327,000	6,680
Thomas Creek	160,000	4,000
Mainstem Umatilla River (Meacham Cr. to Forks)	250,000	2,200
Squaw Creek	238,000	2,000
Birch Creek	346,000	3.400
E. and W. Fork Birch Cr.	724,000	8,600
Buckaroo Creek	126,000	1,200
Ryan Creek	165,500	2,210
Mainstem Umatilla River (Pendleton to Meacham Cr.)	595,000	4,600
TOTAL	$ 3,358,250	$ 38,690
FISHERY REHABILITATION PROJECTS GRAND TOTAL[c]	$10,623,450	$227,032

[a]/ Does not include pumping power costs

[b]/ Costs with enhanced flows of the CRP or CRP/Meacham Dam Plans

[c]/ Does not include cost of the Umatilla Summer Steelhead Hatchery

Table 18. Summary of costs of the Columbia River Pumping Plan (from BR 1985)

Capital/Construction Costs Feature	October 1983 Prices Total Costs
Total project cost	$33,440,000[a]
Interest during construction	3,156,000[b]
PROJECT COST	$36,596,000
Less preauthorization costs	$-3,050,000
Less historical and archeological salvage	-312,000
NET INVESTMENT	$33,234,000

[a]/ Includes incremental cost for West Extension Irrigation District pump of $2,067,000

[b]/ Includes incremental cost associated with West Extension Irrigation District pump of $192,000

Annual Operation/Maintenance Costs Feature		October 1983 Prices Total Costs
Operation, maintenance, and replacements		$101,700
Wheeling (power)		152,200
TOTAL		$253,900
Power cost	Pumping	$356,100
	Power Foregone	23,100
Increment to economic value	Pumping	$499,400
	Power Foregone	32,500

Table 19. Summary of costs of the Columbia River Pumping/Meacham Dam Plan (from BR 1985[a/])

Capital/Construction Costs

Feature	October 1983 Prices Total Costs
	dollars
Meacham Dam and Reservoir	$ 77,200,000
Columbia River pumping plant	13,000,000
Cold Springs Reservoir pumping plant	6,200,000
Stanfield relift pumping plant	1,950,000
Columbia-Cold Springs Canal	5,500,000
Stanfield Canal	1,600,000
Stanfield Relift Canal	2,000,000
Permanent Operating Facilities	70,000
General Investigation Costs	42,000
Interest during construction (8 3/8%)	22,640,000
PROJECT COST	$131,240,000
Less Investigation costs	-4,741,000
Less historical and archeological costs	-1,038,000
NET INVESTMENT	$125,461,000

Annual Operation/Maintenance Costs

Feature	October 1983 Prices Total Costs
	dollars
Pumping Plants	$ 167,600[a/]
Canals	5,000
Meacham Dam and Reservoir	21,000
Hydromet facilities	15,000
Administration and general overhead	10,000
TOTAL	$ 218,600

[a/] Includes $102,500 for wheeling costs, but does not include a cost for pumping power.

Table 20. Criteria used for determining costs of habitat improvement projects in the Umatilla Basin (from CTUIR 1984)

Fencing

Initial - $6,000/mile (both sides of stream)

Annual maintenance - $300/mile

Bank Stabilization

Initial - $50,000/mile for large streams and $25,000/mile for small streams (includes rock rip-rap, planting, and deflectors)

Annual maintenance - $1,000/mile for large streams and $500/mile for small streams

Holding Pools

Initial - $3,000 each

Annual maintenance - $60 each

Deflectors

Initial - $500 each

Annual maintenance - $20 each

Weir

Initial - $1,000 each

Annual maintenance - $20 each

Boulders

Initial - $100 each for the main stem and $50 each for tributaries

Annual maintenance - None

channel, $450,000 for preliminary planning on Three Mile Falls Dam passage improvements, and $100,000 for development of fishery rehabilitation plans for the Umatilla. This does not include operating and personnel costs of federal and state staff permanently assigned to the Umatilla.

Rehabilitation Objectives and Potential Fishery Benefits

In this plan we have estimated the potential fishery benefits of various fishery rehabilitation projects proposed in the Umatilla Basin. Benefits to naturally and hatchery produced anadromous fish have been determined separately.[a/] To estimate benefits of rehabilitation projects, we have used a general life history model for natural and hatchery fish. Since the projects will affect various life stages, benefits were evaluated over one life cycle of natural and hatchery production. We estimated fishery benefits for summer steelhead, fall chinook, and spring chinook, by calculating survival at each life history stage based on the potential effects of one or combination of rehabilitation projects. Projects evaluated fell into four categories: upstream passage improvement, downstream passage improvement, adult and smolt trapping/trucking, and habitat improvement. For practical purposes, projects in each category were evaluated as a whole rather than for each individual project. Our evaluation of habitat improvement projects is limited to Meacham Creek since it was the only stream that data was available to determine fishery benefits. Evaluation of habitat projects in Meacham Creek, however, served as a basis to estimate benefits of habitat improvements in other streams in the basin.

Each project and combination of projects were evaluated under "existing" flows (represented by 40 to 50-year average monthly flows) and three "enhanced"

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a For this plan we define "naturally produced" fish as those that spawned and reared naturally regardless of the origin of the parents. "Hatchery produced" fish are defined as those that spawned and/or reared under artificial conditions.

flows: the McKay Storage Plan and the Bureau of Reclamation's Columbia River Pumping (CRP) and CRP/Meacham Dam Plans. The general approach and results of this analysis for hatchery and naturally produced salmonids are described below.

Natural Production

Approach

Natural escapement objectives for the Umatilla are unknown. These objectives will be determined in part by the results of the U.S. vs. Oregon negotiations (see discussion in Rehabilitation Plan section). However, for purposes of this report we used escapements that would be required to achieve maximum smolt production (production capacities) (Table 21). Assuming production capacities are achieved, we estimated the potential fishery benefits that would result in a single life cycle. Because "available habitat" for anadromous species will vary with flow conditions, we estimated rehabilitation objectives based on existing flows and each enhanced flow. The specific methods used to generate estimates of natural production necessary to seed available habitat are described in detail in Appendix C. Results of this analysis are summarized in Table 21.

Our life history model to estimate benefits to naturally produced fish (Figure 18) begins with the number of adult spawners needed for maximum smolt production (Table 21) arriving at the mouth of the Umatilla River. From this number we subtracted adult losses as this "hypothetical" fish population is

Table 21. Number of adult spawners necessary to seed available habitat for maximum smolt production of anadromous salmonids in the Umatilla River.

	Existing flows	Enhanced flows		
		Long Term Projects[a]		Interim Project[b]
		CRP Plan	CRP/Meacham Dam Plan	McKay Storage Plan
Summer steelhead[c]	1,881	1,881	2,859	1,881
Fall Chinook	11,097	10,890	11,403	11,097
Spring chinook	582	582	1,166	582

[a] Projects are potential long term solutions to the basin's fishery problems.
[b] Project would be used as an interim measure to enhance flows until the CRP or CRP/Meacham Dam Plans are implemented.
[c] Production figures were averaged from two estimates.

moved up the river to spawn. The number of adults arriving at the mouth and entering the river will vary for existing and enhanced flows. The number of adults surviving to spawn is influenced by flow enhancement as well as upstream passage improvement, and adult trucking projects. From the number of surviving adults, we calculated the number of smolts produced. These smolts were then moved downstream and the number of smolts surviving to the lower river was calculated. Projects influencing survival of smolts include flow enhancement, downstream passage improvement, habitat improvement, and smolt trucking projects. From the number of smolts surviving to the lower river, the number of adult returns to the mouth of the Umatilla River was calculated. We used adult returns to the mouth of the Umatilla River as our measure of the benefit of rehabilitation projects to naturally produced salmonids. A detailed account of methods to determine fishery benefits is given in Appendix D and two examples with detailed calculations of fishery benefits for both natural and hatchery production are given in Appendix E.

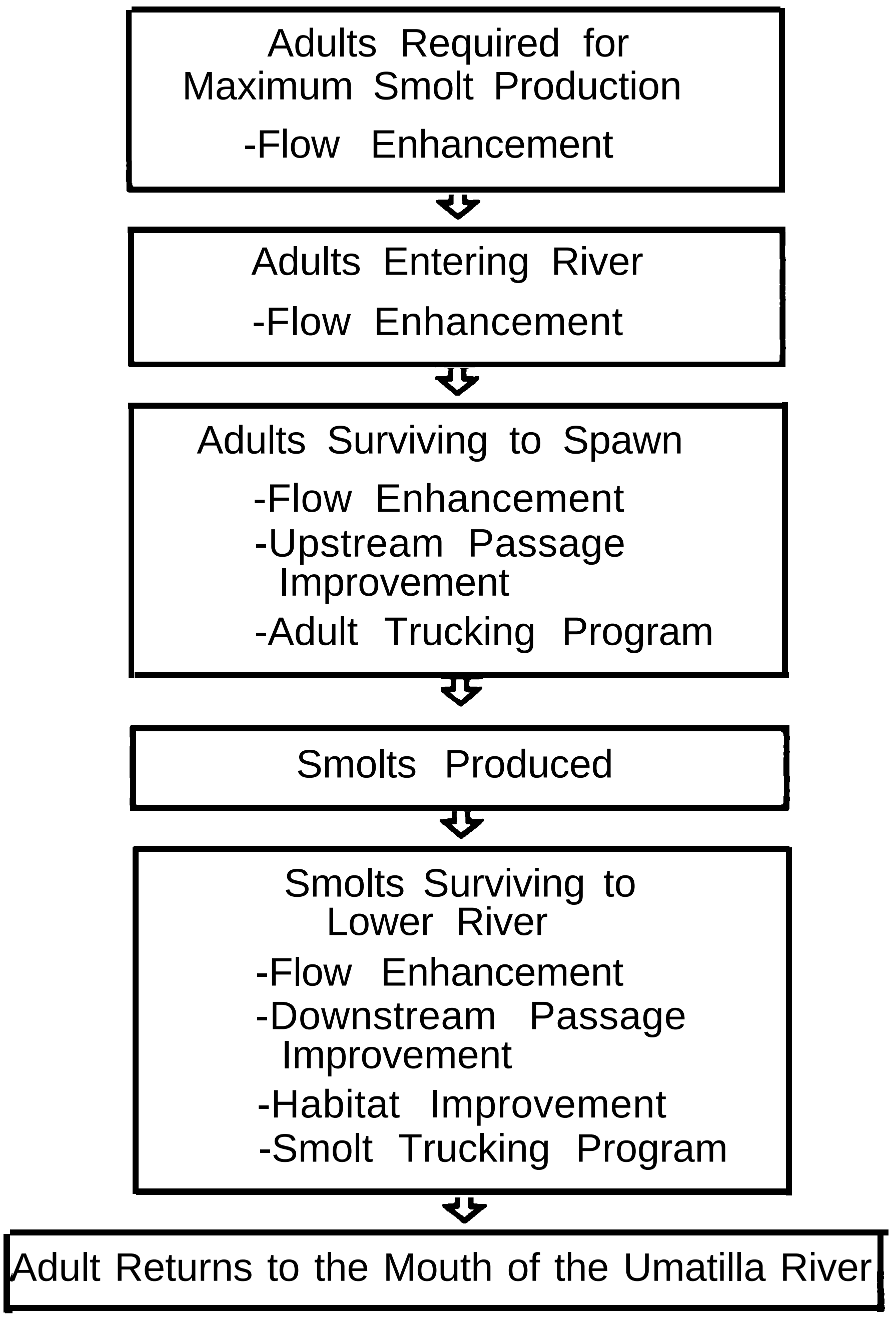

Figure 18. Life history model used to determine benefits of fishery rehabilitation projects in the Umatilla River to naturally produced salmonids. Projects influencing each life history stage are listed. Details of the method are described in Appendix D.

It should be emphasized that the purpose of this modeling effort was to compare fishery benefits derived from accomplishment of one or several fishery rehabilitation projects under four flow regimes. Since most production and survival data used was from nearby rivers or was estimated (because of a general lack of data for the Umatilla), the accuracy of our results in absolute terms is unknown at this time. Our estimates of fishery benefits shown in Tables 22 (natural production) and 24 (hatchery production) therefore should be viewed relative to each other. The actual accomplishments of the rehabilitation projects either Under existing or enhanced flows will be determined through a comprehensive evaluation program (see Plan Evaluation section for additional discussion).

Results

Potential benefits of rehabilitation projects to naturally produced salmonids are given in Table 22. Under each of the flows, accomplishment of rehabilitation projects would provide substantial fishery benefits to natural production of summer steelhead, fall chinook, and spring chinook in the Umatilla River. Under existing flows, we could achieve ultimate returns of 2,965 summer steelhead, 5,204 fall chinook, and 603 spring chinook, if upstream and downstream passage and habitat improvement projects are completed and adults and smolts are trucked when necessary. Ultimate returns of fall chinook under existing flows could be achieved without habitat improvement projects; however, all rehabilitation projects including habitat improvement must be accomplished to achieve ultimate returns of all species. If no

Table 22. Natural production fishery benefits[c/] (in terms of adult returns to the mouth of the Umatilla River)[d/] from fish rehabilitation projects in the Umatilla River.

Projects	Existing Flows			Enhanced Flows: Long Term Projects[a/]: CRP Plan			Enhanced Flows: Long Term Projects[a/]: CRP/Meacham Dam Plan			Enhanced Flows: Interim Project[b/]: McKay Storage Plan		
	StS	ChF	ChS	StS	ChF	ChS	StS	ChF	ChS	StS	ChF	ChS
1. No action	682	3	41	1,169	956	214	1,869	2,764	667	682	7	41
Passage and Habitat Projects												
2. Upstream Passage Improvement Only	1,115	222	152	1,505	2,368	437	2,336	3,846	1,042	1,115	319	152
3. Downstream Passage Improvement Only	867	12	51	1,469	3,751	268	2,327	7,831	815	867	31	51
4. Habitat Improvement Only[f/]	1,228	3	74	2,105	956	385	3,364	2,764	1,201	1,228	7	74
5. Upstream and Downstream Passage Improvement	1,416	973	190	1,891	9,285	546	2,905	10,896	1,274	1,416	1,401	190
6. Upstream and Downstream Passage and Habitat Improvement	2,550	973	342	3,404	9,285	983	5,229	10,896	2,294	2,550	1,401	342
Trucking Projects[e/]												
7. Adult and Smolt Trucking Only	793	1,117	204	1,169	2,630	387	1,869	3,953	822	793	1,326	204
All Projects Implemented												
8. Passage, habitat and trucking[e/] Projects	2,965	5,204	603	3,404	11,217	1,162	5,229	11,920	2,460	2,965	6,241	603

a/ b/ See footnotes in Table iii.

c/ Does not include benefits to ocean and Columbia River fisheries which would be substantial. In addition, does not include "non-production" benefits from both the CRP and CRP/Meacham Dam Plans: 1) Tribes treaty reserved right to salmon and steelhead would be achieved; 2) Conflict involving stream flows between Indians and non-Indians would be resolve; 3) Optons for Indian and non-Indian harvest and management would be increased; 4) Value (percentage of fish in "bright" condition) of fall chinook entering the Umatilla would be increased; and 5) Need for trucking would be reduced (see text for additional explanation).

d/ For purposes of the model, we assumed no harvest in the Umatilla River.

e/ Project would be used as interim measure to restore passage until the CRP or CRP/Meacham Dam Plans are implemented.

f/ Meacham Creek only.

projects are implemented, only 682 summer steelhead, 3 fall chinook, and 41 spring chinook would be produced.

Potential fishery benefits of the rehabilitation projects are greatest under the CRP/Meacham Dam Plan, especially fall chinook. Ultimately, 5,229 summer steelhead, 11,920 fall chinook, and 2,460 spring chinook could be produced. The reasons for greater production of fall chinook are threefold:

1. There would be no loss in production due to delay in migration of adults. With existing low flows in the fall, we estimated a 25% loss in production due to delay in the upstream migration of adults (Appendix D). This loss would result from spawning of adults before reaching upper Umatilla River spawning areas and increased mortality due to the delay. If the CRP/Meacham Dam Plan is implemented there would be adequate flows for upstream migration when adults arrive at the mouth of the Umatilla in early fall.

2. There would be increased survival of adults over upstream passage obstructions. As shown in Table D-18 in Appendix D, even with upstream passage improvements, survival of fall chinook to Three Mile Falls Dam would be only 63.8% under existing flows. However, with enhanced flows of the CRP/Meacham Dam Plan, we estimate that all fall chinook would survive to Three Mile Falls Dam.

3. There would be slightly increased survival of juveniles in the lower stream channel. We assumed that the juveniles that would not

survive in the lower stream channel would be trucked (Appendix D). For fall chinook fingerlings, we assumed a 10% mortality from trucking. Because fewer juveniles need to be trucked, survival of fall chinook fingerlings is 3% higher under CRP/Meacham Dam Plan than existing flows (Table D-19, Appendix D).

The greater production of summer steelhead and spring chinook under the CRP/Meacham Dam Plan would result from increased survival of adults to Three Mile Falls Dam and increased production of smolts due to increased summer flows by Meacham Creek Dam (Appendix D). Unlike fall chinook, the CRP/Meacham Dam Plan would not increase survival of summer steelhead and spring chinook smolts in the lower channel since we assumed all smolts could be saved by trucking.

Fishery benefits would be somewhat less under the CRP than the CRP/Meacham Dam Plan (Table 22). Ultimately, 3,404 Sumner steelhead, 11,217 fall chinook, and 1,162 spring chinook could be produced. Similar to the CRP/Meacham Dam Plan, the production of fall chinook would increase compared to existing flows due to greater numbers of adults entering the river and improved survival of adults to Three Mile Falls Dam. The slightly lower production of fall chinook under the CRP than the CRP/Meacham Dam Plan would be caused by lower survival of adults to Three Mile Falls Dam (99.0% versus 100.0%) and reduced spawning potential (10,890 versus 11,403) (Table 21) at the lower flows during fall months. Production of summer steelhead and spring chinook would be less under the CRP than the CRP/Meacham Dam Plan since smolt production would not be increased. Unlike the CRP/Meacham Dam Plan, the CRP Plan will not provide any additional summer flow in Meacham Creek or any other headwater tributary used for rearing by summer steelhead and spring chinook.

Fishery benefits would be slightly greater under the McKay Storage Plan than existing flows, increasing returns of fall chinook to 6471. This estimated increase may be conservative. In our calculation of fishery benefits, we assumed that the uncontracted storage in McKay (4,280 acre-feet) would be released at 70 cfs/day for 30 days in October. Greater fishery benefits could be achieved by selectively releasing greater amounts of water during days of peak migration in October and other months of chinook migration. Similar to CRP and CRP/Meacham Dam flows, adult chinook would enter earlier under McKay Storage Plan than present flows in the desired "bright" condition. Since the McKay Storage Plan is designed to improve upstream passage of fall chinook, there would be no additional fishery benefits to summer steelhead and spring chinook.

Under each of the flows, accomplishment of all rehabilitation projects is necessary to achieve maximum fishery benefits of the rehabilitation plan. Fishery benefits would be minimal if individual projects were completed; however, because survival of fish over the series of dams, screens, and instream obstructions are multiplicative (see Appendix D), fishery benefits are greatly increased as all projects are completed.

With downstream passage improvements at screened and unscreened diversions, survival of juveniles is assumed to be 100% at each of the flows (Appendix D). Differences in fishery benefits between flows, therefore, would not be due to differences in survival of juveniles between flows at diversions.

As discussed earlier, our evaluation of fishery benefits from habitat improvements was limited to Meacham Creek. For Meacham Creek, we predicted a 3.0-fold increase in number of summer steelhead and spring chinook smolts produced (or a 1.8-fold increase in the basin's population assuming 40% spawn and rear in Meacham Creek). Assuming smolt production would increase similarly from habitat improvements in other streams, smolt production of summer steelhead and spring chinook could increase 10-fold with completion of all proposed habitat projects. Using our life history model, this would increase the number of adults ultimately produced in the basin as follows:

Existing Flows		CRP Plan		CRP/Meacham Dam Plan		McKay Storage Plan	
sts	ChS	sts	ChS	sts	ChS	sts	ChS
4,941	1,005	5,673	1,937	8,716	4,100	4,941	1,005

These estimates are preliminary and will be refined when additional evaluations are done.

Adult returns in Table 22 will include two components:

1) An escapement needed for seeding of natural production areas.

2) A surplus which could potentially be harvested in the Umatilla River.

As previously mentioned, natural escapement objectives for the Umatilla are unknown pending outcome of U.S. vs. Oregon negotiations. However, if we assume the runs would be managed for full (maximum) seeding of natural production areas, the harvestable surplus (if any) can be estimated by the difference in adult returns to the mouth of the Umatilla River (Table 22) and the estimated number of adults required for maximum smolt production (Table 21). The surplus or deficit (in parenthesis) spawners at each flow with completion of all rehabilitation projects after one life cycle projects is given below.

	Summer Steelhead			Fall Chinook			Spring Chinook		
	Adult Return	Adults for Full Seeding	Surplus/ Deficit	Adult Return	Adults for Full Seeding	Surplus/ Deficit	Adult Return	Adults for Full Seeding	Surplus/ Deficit
Existing Flows	2,965	1,881	1,084	5,204	11,097	(-5,893)	603	582	21
CRP Plan	3,404	1,881	1,523	11,217	10,890	327	1,162	582	580
CRP/ Meacham Dam Plan	5,229	2,859	2,370	11,920	11,403	517	2,460	1,166	1,294
McKay Storage Plan	2,965	1,881	1,084	6,241	11,097	(-4,856)	603	582	21

The above data suggest that only under the enhanced flows would returns of all Species be sufficient for full seeding of natural production areas and support of in-river fisheries. However, because of poor survival during upstream migration, escapements of fall chinook will be below full seeding under existing and McKay Storage Plan flows.

Our assessment of rehabilitation projects does not include benefits to ocean and Columbia River fisheries. Applying catch to escapement ratios estimated by ODFW (Bohn, unpublished data), the number of fall and spring chinook harvested in ocean and Columbia River fisheries can be estimated by multiplying adult returns to the Umatilla River (Table 22) by 3 and 1, respectively. The number of summer steelhead harvested in Columbia River fisheries can be estimated by multiplying adult returns by 1.5.

There would be several additional benefits from both the CRP and CRP/Meacham Dam Plans:

1) Tribes treaty reserved right to salmon and steelhead would be achieved. Adults would be able to swim upstream to natural spawning areas, usual and accustomed fishing sites, and collection facilities on Reservation land.

2) Conflict involving stream flows between Indians and non-Indians would be substantially reduced thus reducing risk of litigation.

3) Options for Indian and non-Indian harvest and management in the lower Umatilla would be increased. The truck and haul program would "bypass" much of the lower river eliminating harvest and natural spawning. In addition, migrations of chinook with a flow project could be extended for one or more months which would increase availability of fish for harvest.

4) Value of fall chinook entering the Umatilla would be increased. Under existing flows, the upstream migration of fall chinook will be delayed until shortly before adults will spawn. Adults may be ripe when they become available to the Umatilla River fisheries which would be undesirable. Under the CRP and CRP/Meacham Dam Plans, however, adults could enter earlier in "bright" condition which would be more valuable for in-river fisheries.

Hatchery Production

Approach

We used production objectives as a starting point for estimating benefits of rehabilitation projects to hatchery fish. Objectives for fall and spring chinook correspond to adult production goals established by CTUIR and ODFW (CTUIR 1984). We calculated numbers of smolts that must be released to achieve these production goals (Table 23) based on available data on survival rates.

Hatchery objectives for summer steelhead were estimated from the number of adults expected to return from future releases of 200,000 smolts from Bonifer and Minthorn Springs facilities. The specific methods, survival rates, and assumptions for the estimates in Table 23 are described in greater detail in Appendix C.

Table 23. **Hatchery production objectives (in terms of adult returns to Bonifer and Minthorn Springs adult collection/juvenile release facilities) for anadromous salmonids in the Umatilla River.**

	Adults	Releases required to achieve objectives Smolts	Fingerlings
Summer Steelhead	5,400	200,000[a]	--
Fall Chinook	10,000	225,000[b]	2,958,350[c]
Spring Chinook	10,000	1,666,667[d]	--

a Assuming a 2.7% survival rate.
b Assuming a 0.5% survival rate.
c Assuming a 0.3% survival rate.
d Assuming a 0.6% survival rate.

A life history model to estimate benefits of rehabilitation projects for hatchery produced fish is shown graphically in Figure lg. The model begins with the number of smolts required to achieve production objectives in Table 23. We moved this hypothetical population of fish downstream from the point of release (Bonifer and Minthorn) where survival of hatchery smolts will be influenced by flow enhancement, downstream passage improvement, and smolt trucking projects. From the surviving smolts, we computed the number of adults produced and estimated the number of adults entering the river as affected by the flow enhancement projects. Finally, adults were moved upstream and the number surviving to Bonifer and Minthorn was totaled. As for naturally produced salmonids, survival of adults during the upstream migration will be influenced by flow enhancement, upstream passage improvement, and adult trucking projects. Adult returns to Bonifer and Minthorn completes the life cycle of the model and serves as our measure of potential hatchery production benefits.

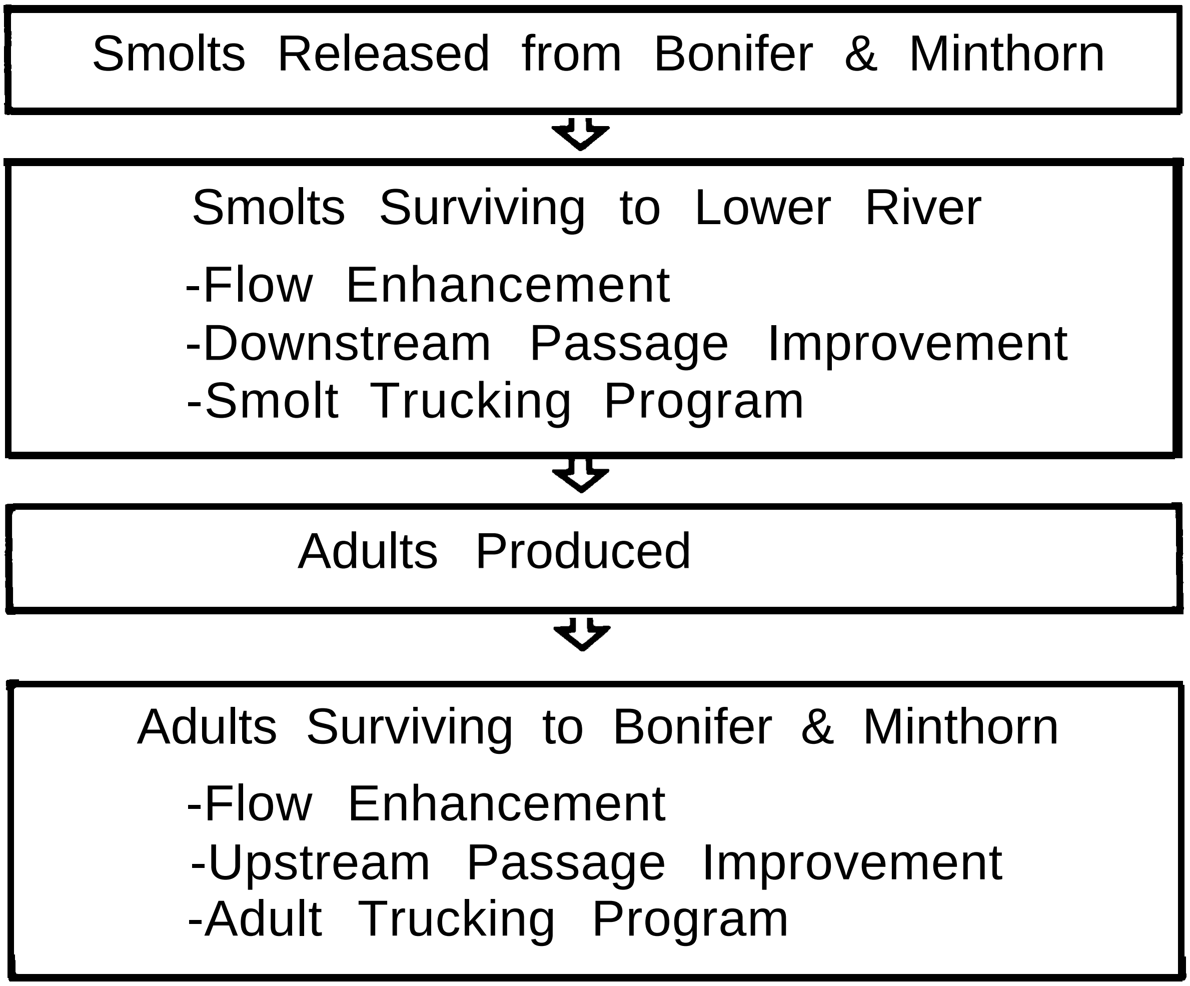

Figure 19. Life history model used to determine benefits of fishery rehabilitation projects to hatchery salmonids in the Umatilla River. Details of the method are described in Appendix D.

Results

Under each of the flows, accomplishment of rehabilitation projects would provide substantial fishery benefits to hatchery production of Sumner steelhead, fall chinook, and spring chinook (Table 24). Under existing flows, we could achieve ultimate returns of 4,379 summer steelhead, 4,495 fall chinook, and 4,797 spring chinook if upstream and downstream passage improvements are completed and adults and smolts are trucked when necessary. If no action is taken, only 2,080 summer steelhead, 3 fall chinook, and 565 spring chinook would be produced.

Fishery benefits of the rehabilitation projects to hatchery production would be greatest under the enhanced flows of the CRP/Meacham Dam Plan. Ultimately, 5,081 Sumner steelhead, 9,955 fall chinook, and 9,765 spring chinook could be produced. The greater production of all species would result solely from increased numbers of adults entering the river and improved survival of adults to Three Mile Falls Dam. Unlike natural production, production of hatchery summer steelhead and spring chinook smolts would not be increased by the higher summer flows from Meacham Creek Dam.

Fishery Benefits of the rehabilitation projects would be nearly as great under the CRP Plan as the CRP/Meacham Dam Plan. With completion of projects, 5,027 summer steelhead, 9,810 fall chinook, and 9,235 spring chinook ultimately could be produced. Fish production of fall and spring chinook would be slightly lower than the CRP/Meacham Creek Plan due to slightly lower survival of adults to Three Mile Falls Dam. (Appendix D).

Table 24. Hatchery production fishery benefits[c] (in terms of adult returns to Bonifer and Minthorn Springs adult collection/juvenile release facilities)[d] from fish rehabilitation projects in the Umatilla River.

				Enhanced Flows								
				Long Term Projects[a]						Interim Project[b]		
	Existing Flows			CRP Plan			CRP/Meacham Dam Plan			McKay Storage Plan		
Projects	StS	ChF	ChS	StS	ChF	ChS	StS	ChF	ChS	StS	ChF	ChS
1. No action	2,080	3	566	3,369	1,206	3,011	3,509	3,414	4,819	2,080	9	566
Passage and Habitat Projects												
2. Upstream Passage Improvement Only	3,401	287	2,116	4,338	2,986	6,130	4,385	4,778	7,535	3,401	413	2,116
3. Downstream Passage Improvement Only	2,411	12	729	3,904	3,280	3,840	4,066	6,540	5,820	2,411	28	729
4. Upstream and Downstream Passage Improvement	3,941	893	2,727	5,027	8,121	7,820	5,081	9,100	9,110	3,941	1,345	2,727
Trucking Projects[e]												
5. Adult and Smolt Trucking Only	2,311	1,312	2,833	3,369	3,313	5,439	3,509	4,882	5,944	2,311	1,560	2,833
All Projects implemented												
6. Passage and trucking[e] projects	4,379 (5,400)[f]	4,495 (9,823)[f]	4,797 (10,000)[f]	5,027 (5,400)[f]	9,810 (10,000)[f]	9,235 (10,000)[f]	5,081 (5,400)[f]	9,955 (10,000)[f]	9,765 (10,000)[f]	4,379 (5,400)[f]	5,389 (9,823)[f]	4,797 (10,000)[f]

a b c d e See footnotes in Table 22.

f Returns to the mouth of the Umatilla before in-river harvest and mortality associated with upstream passage problems.

The McKay Storage Plan would provide slightly greater fishery benefits than under existing flows, increasing returns of fall chinook to 5,389. No increase in production of summer steelhead and spring chinook would occur since the McKay Storage Plan is designed to enhance upstream passage conditions for fall chinook.

Adult returns to Bonifer and Minthorn in Table 24 will include two components:

1) Adults required for hatchery production.

2) A surplus which could be harvested or used for supplementation of natural stocks.

It is estimated (using data in Table 26) that 101 summer steelhead, 1,925 fall Chinook, and 136 spring chinook adults will be needed to achieve hatchery release objectives (Table 23). The surplus (adults in addition to those needed for hatchery production) at each flow with completion of all projects after one life cycle would be as follows:

	Sumner Steelhead	Fall Chinook	Spring Chinook
Existing Flows	4,278	2,570	4,661
CRP Plan	4,926	7,885	9,099
CRP/Meacham Dam PI an	4,980	8,030	9,629
McKay Storage Plan	4,278	3,464	4,661

As shown, the number of surplus adults which could be harvested or used for supplementation of natural stocks would be greater under the enhanced flows

(4,926-4,980 steelhead, 7,885-8,030 fall chinook, and 9,099-9,625 spring chinook) than existing or McKay Storage Plan flows (4,278 steelhead, 2,570-3,464 fall chinook, and 4,661 spring chinook),

Similar catch to escapement ratios used for naturally produced fish can be used to estimate contribution of hatchery adults to ocean and Columbia River fisheries.

Under present and McKay Storage Plan flows, survival of adults to Bonifer and Minthorn will be poor. Until greater flows are achieved, broodstock collection and harvest of hatchery adults will probably be done near the river mouth. In Table 24, we show returns of hatchery adults to the mouth of the Umatilla (in parathensis). At present and McKay Plan flows, approximately 16-30% of fall and spring chinook and 81% of summer steelhead returning to the river would survive to the facilities. At CRP and CRP/Meacham Dam flows, 78-94% of fall and spring chinook and 93-94% of steelhead would survive to the facilities.

Proposed Rehabilitation Plan

Priorities and Schedules for Implementation

The proposed plan for rehabilitation of anadromous salmonids in the Umatilla Basin is summarized in Table 25. The table suggests priorities and implementation schedules for fishery rehabilitation and flow enhancement projects over five fiscal years (in terms of years to complete, subsequent to initial start-up of the Rehabilitation Plan). We have listed the proposed rehabilitation and flow enhancement projects separately. Although the rehabilitation projects are listed in order of priority, all g projects plus the flow enhancement proposals must be completed to achieve the maximum (ultimate) fishery benefits listed in Tables 22 and 24. Tables 22 and 24 also indicate benefits if only some of the projects are completed. To assure of achieving greatest benefits in a cost effective manner, continuous exchange between plan implementors and decision makers must occur. As decisions are made, projects are completed, and as biological, social, or political issues are identified, the plan will be updated and amended.

We have not listed in Table 25 the rehabilitation projects which have been implemented: Bright fall chinook reintroduction and broodstock development; Bonifer and Minthorn Springs adult collection/juvenile release facilities; and Lower Umatilla River channel modification. The rationale for project priorities and implementation schedules is discussed below.

Table 25. Umatilla River fishery rehabilitation plan -- priorities and schedules for implementation.

FW Program Reference	Project	Implementation Schedule Years to Complete a/ 1	2	3	4	5
	Flow Enhancement Projects					
704(d)(Z)	1. McKay Storage Plan	0				
	2. Bureau of Reclamation's CRP or CRP/Meacham Dam Plans	+	+	+	+	0
	Fishery Rehabilitation Projects					
704(i)(l)	1. Hatchery facility for 200K Sumner steelhead	+	0			
	2. Fall and spring chinook and coho hatchery production	+	+	+	+	0
704(d)(l) Table 2	3. Three Mile Falls upstream and downstream passage improvement	+	+	0		
	4. Adult and smolt trapping/trucking program		+	0		
	5. Westland upstream and downstream passage improvement and smolt trapping facility		+	0		
	6. Cold Springs upstream and down-stream passage improvement			+	0	
	7. Maxwell and Stanfield upstream and downstream passage improvement				+	0
	8. Small diversions downstream passage improvement					
	a. Brownell and Dillon	+	0			
	b. Umatilla River unscreened diversions (5)		+	0		
	c. Birch Creek unscreened diversions (11)			+	0	
	9. Habitat improvement					
	a. Meacham and North Fork Meacham Creeks		+	+	0	
	b. North and South Fork Umatilla River Thomas Creek	+	+	0		
	c. Mainstem Umatilla River (Meacham Creek to Forks)		+	+	0	
	d. Squaw Creek			+	0	
	e. Birch and East and West Fork Birch Creeks			+	+	0

a/ Subsequent to initial start-up of the rehabilitation plan.
± Project initiation
0 Project completion

Flow Enhancement Projects

Lack of stream flows has been identified as the chief factor limiting production of anadromous salmonids in the Umatilla Basin. Agricultural water uses have directly contributed to these flow deficits and is the key factor causing conflict between Indian and non-Indian water interests in the basin. A flow enhancement project must eventually be implemented to resolve these basic water use conflicts. While the proposed rehabilitation measures alone will provide substantial fishery benefits, flow enhancement holds the greatest promise for resolving long term fish and water use problems. We have given the Bureau's flow enhancement projects top priority for the following reasons:

1) Natural escapement objectives for all species would be achieved on a sustained basis.

   Assuming completion of rehabilitation projects, only under the Bureau's flow enhancement proposals would returns be sufficient for full seeding of available natural habitat and support of in-river fisheries. Under existing flows, survival of fall chinook during their upstream migration will be poor and escapements will be below full seeding. Annual supplementation would be necessary to make up the deficit of nearly 6,000 adult spawners.

   Of the Bureau's two flow enhancement projects, we give the CRP Plan (the Bureau's Recommended Plan) highest priority since it would provide the greatest returns at the least cost.

2) Tribes treaty reserved right to salmon and steelhead would be achieved.

Adults would be able to swim upstream to natural spawning areas, usual and accustomed fishing sites, and collection facilities on Reservation land.

3) Conflict involving stream flows between Indians and non-Indians would be resolved thus eliminating risk of litigation.

4) Options for Indian and non-Indian harvest and management in the lower Umatilla would be increased.

Enhanced instream flow is preferred since a truck and haul program would "bypass" much of the lower river eliminating harvest and natural spawning. Additionally, migrations of chinook with a flow project could be extended for one or more months which would extend availability of fish for harvest.

5) Value of fall chinook entering the Umatilla would be increased.

Under existing flows, the upstream migration of fall chinook will be delayed until shortly before adults will spawn (November). Adults may be ripe when they become available to Umatilla River fisheries which would be undesirable. Under the CRP and CRP/Meacham Dam Plans, however, adults could enter earlier (beginning September 16) in "bright" condition which would be more valuable for in-river fisheries.

6) Need for trucking would be reduced.

A large scale trucking program would create many logistic, operation, and maintenance problems and would be costly. Given the unprecedented return of natural and hatchery produced salmon to the Umatilla, and the fact that adults are on a spawning migration, would create extreme logistic, operation, and maintenance problems and would increase costs over $17,000/year. Trucking would stress fish and would cause some pre-spawning mortality. In addition, trucking would not help foster stocks that would be adapted to natural low flow conditions in the Umatilla.

Fishery Rehabilitation Projects

Hatchery Facility for 200K Summer Steelhead; Fall and Spring Chinook and Coho Production

It will take several years of intensive hatchery reintroduction and supplementation to achieve natural and hatchery production goals. Our priority, therefore, is to implement all hatchery production projects first (projects 1 and 2 in Table 25). The Fish and Wildlife Program of the Northwest Power Planning Council (NPPC 1984) calls for the rehabilitation of chinook and coho salmon and summer steelhead in the Umatilla River (Measure 704(d)(1), Table 2). Even with flow enhancement, natural and hatchery production will not be adequate to fully address the Tribes treaty reserved right to salmon and steelhead and to achieve production objectives of the Rehabilitation Plan. Therefore, hatchery summer steelhead, fall chinook, and spring chinook will be required on a continuing basis to achieve Tribal and escapement needs in the Umatilla. Although not included in the current plan, hatchery fish will also be needed for rehabilitation of coho in the basin. Measure 704(i)(l) provides for a hatchery to rear 200,000 steelhead smolts for the Umatilla. However, there has been no provision to date in the Council's program to provide hatchery salmon for the Umatilla.

To facilitate an early attempt to rehabilitate fall chinook in the Umatilla River, the ODFW has redirected release of part of the John Day mitigation fall chinook to the Umatilla River. These fish are being produced to mitigate the inundation of fall chinook spawning area by John Day Dam. The total mitigation requires a return of 30,000 adults to the spawning area (U.S. Army Corps of Engineers-Design Memorandum No. 46) and another 30,000 to in-river fisheries; i.e., a total return of 60,000 adult fall chinook to the mouth of the Columbia River. ODFW's share of this mitigation is 30,000 adults returning to the mouth of the Columbia. With the consummation of the U.S.-Canada Treaty, the return of chinook to the Columbia River should increase since ocean fisheries on Columbia chinook will be reduced. This means that the total return of John Day mitigation fish to the mouth of the Columbia should ultimately exceed 60,000. The amount of the increase must be estimated based on the reduction of ocean catch.

Rehabilitation of fall chinook in the Umatilla River must be accomplished with adults that are additional to returns resulting from John Day mitigation.

Returns of ODFW mitigation fish (upriver brights) released from Bonneville Hatchery have thus far ranged from 8,800-14,400 adults; at best, less than half Oregon's mitigation requirement to the mouth of the Columbia. When this production is redirected to upriver release locations, above several main stem dams, it is obvious that John Day mitigation will not be met at the existing production level. Thus, there is no surplus from the existing John Day mitigation production which in the long term can be credited to offsite mitigation of fall chinook in the Umatilla River. In the long-term, production of hatchery fall chinook must be adequate to achieve adult returns required for the John Day Dam mitigation and to achieve adult return objectives in the Umatilla Rehabilitation Plan.

Spring chinook and coho have yet to be reintroduced, but the first release of spring chinook (Carson stock) will be made in 1986. Production of hatchery spring chinook and coho salmon for the Umatilla may be determined in part by the results of the ongoing U.S. vs. Oregon negotiations. These negotiations will seal with the role of reprogramming of Mitchell Act hatcheries in providing hatchery fish for upriver release. This could include reprogramming of fish for release into the Umatilla River. Discussions thus far have focuses on reprogramming Mitchell Act hatcheries for upriver release of coho and possibly spring chinook. Regardless of this outcome, additional hatchery capacity will likely be needed for spring chinook in the Umatilla River since reprogrammed fish would be apportioned among several tributaries, and there probably would be too few fish available for the Umatilla to achieve plan objectives. Acceptance of the Umatilla Plan by the Council will provide needed hatchery production for spring chinook and coho as well as fall chinook.

We present in Table 26 hypothetical build-up rates for summer steelhead and fall and spring chinook programs planned for the basin. For this exercise it was necessary to estimate year of completion of the Umatilla Summer Steelhead Hatchery (FY 1987), screening of diversion for fall chinook fingerlings (FY 1989), and initial release of spring chinook smolts (FY 1986). Return data are to the mouth of the Umatilla. Return to the collection facilities at each of the flows can be estimated using data in Table D8.

Releases of 60,000 summer steelhead smolts will be made until FY 1987. The Umatilla River Summer Steelhead Hatchery is scheduled for completion in FY 1987 and the first release of 200,000 summer steelhead smolts will be made in FY 1988. At releases of 200,000 smolts, we project a return of 5,400 adults (our hatchery production objective) to the mouth of the Umatilla River could be achieved in 2 years (Table 26).

Releases of 225,000 upper river bright fall chinook yearlings will be made until FY 1988; however, fingerling releases could be made starting in FY 1989 after major screening problems in the basin have been corrected. At future releases of 225,000 yearlings and about 3.0 million fingerlings, we estimate that we could reach our hatchery rehabilitation objective in 4 years (Table 26).

Planning for spring chinook reintroduction and broodstock development will begin in 1986. The first release of spring chinook yearlings will be made in 1986. With future releases of about 1.67 million smolts, we could achieve our goal of 10,000 hatchery adults in 4 years (Table 26).

Table 26. Estimated adult returns (to the mouth of the Umatilla River) and adult surpluses for current and future hatchery releases of anadromous salmonids in the Umatilla River. We assumed that the number of juveniles released was limited by number of adults returning to the river. If possible, however, we will release greater numbers of smolts to achieve production goals sooner.

	Fiscal Year								
	1983	1984	1985	1986	1987	1988	1989	1990	1991
Summer Steelhead									
Hatchery release 1+[a]	60,000	60,000	60,000	60,000	60,000	200,000	200,000	200,000	
Adult return	0	810	1,620	1,620	1,620	1,620	3,510	5,400	
Adult surplus [c]	0	779	1,589	1,589	1,519	1,519	3,409	5,299	
Fall Chinook	1983	1984	1985	1986	1987	1988	1989	1990	1991
Hatchery release 0+[a]	0	0	0	0	0	0	1,093,680[d]	1,697,850	2,958,350
Hatchery release 1+[a]	100,000	225,000	225,000	225,000	225,000	225,000	225,000	225,000	225,000
Adult return	0	84	283	662	1,050	1,125	1,125	1,676	2,598
Adult surplus [c]	0	0	147	526	914	989	329	513	673
	1992	1993	1994	1995					
Hatchery release 0+[b]	2,958,350	2,958,350	2,958,350	2,958,350					
Hatchery release 1+[a]	225,000	225,000	225,000	225,000					
Adult return	4,168	6,223	8,442	10,000					
Adult surplus [c]	2,243	4,298	6,517	8,075					
Spring Chinook	1983	1984	1985	1986	1987	1988	1989	1990	1991
Hatchery release 1+[a]	0	0	0	225,000	225,000	225,000	828,800	1,666,667	1,666,667
Adult return	0	0	0	0	65	787	1,347	1,524	3,703
Adult surplus [c]	0	0	0	0	0	262	449	467	2,646
	1992	1993	1994						
Hatchery releases 1+[a]	1,666,667	1,666,667	1,666,667						
Adult returns	7,897	9,990	10,000						
Adult surplus [c]	6,840	8,933	8,943						

a Smolt (yearling) releases
b Fingerling (subyearling) releases
c Adults in excess of broodstock needs which could be harvested or used to supplement natural populations.
d Assumed fingerlings would be released beginning after major screening problems in the Umatilla River have been corrected

Table 26 (Cont.)

Data used for calculations:

Adult Age Composition

Summer steelhead - 50.0% 1-salt, 50.0% 2-salt (Robart, unpublished data)
Fall chinook - 16.8% age 2, 18.8% age 3, 52.4% age 4, 12.0% age 5 (Hansen, unpublished data)
Spring chinook - 4.8% age 3, 53.5% age 4, 41.5% age 5, 0.2% age 6 (ODFW et al. 1984)

Broodstock mortality

All species - 25% (estimated)

Sex ratio

All species - 50% female, 50% male (estimated)

Fecundity

Summer steelhead - 5,000 eggs/female (ODFW unpublished data)
Fall chinook - 4,200 eggs/female (ODFW unpublished data)
Spring Chinook - 4,000 eggs/female (Knox et al. 1984)

Egg-to-Smolt Survival

All species - 70% (estimated)

Smolt-to-Adult Survival

Summer steelhead - 2.7% (Olsen et al. 1984)
Fall chinook - 0.5% (yearling releases) (Hansen 1983 and unpublished data), 0.3% (fingerling releases) (Hansen 1983 and unpublished data; Foster, unpublished data)
Spring chinook - 0.6% (Robart, unpublished data)

Three Mile Falls Upstream and Downstream Passage Improvement

Our third priority (following the two hatchery production projects) is to improve upstream and downstream passage at Three Mile Falls Dam. Three Mile Falls Dam is prioritized ahead of the other dams because it is one of the worst dams for adult and juvenile passage and the trapping facility at the dam (which will be installed as part of the project) will be needed so adults can be trapped and trucked upstream. Improvements on the east bank ladder are scheduled for completion FY 1987 and WEID construction and improvements on the west bank ladder are scheduled for completion FY 1988.

Adult and Smolt Trucking Program

Our fourth priority is to replace and provide additional trucks to haul adults from Three Mile Falls Dam and haul smolts from Westland smolt trap and Bonneville Hatchery (and eventually the Umatilla River Summer Steelhead Hatchery). As previously discussed, trapping/trucking projects will primarily serve to restore passage in the basin until the flow enhancement projects are implemented. Although trucking needs will be substantially reduced after implementation of the flow projects (especially for fall chinook), trapping/trucking will still be necessary during years of low flows and to perform various mitigation operations in the basin.

Westland Upstream and Downstream Passage Improvement and Smolt Trapping Facility

These projects at Westland are listed as our fifth priority since West-land is the worst dam for adult and juvenile passage (after Three Mile Falls Dam) and the smolt trapping facility is needed to accommodate increased numbers of smolts that will be produced in the Umatilla. Improvements at Westland Diversion Dam and Screen and the smolt trapping facility are tentatively scheduled for completion early in FY 1988 prior to the first release of smolts from the Umatilla River Summer Steelhead Hatchery.

Cold Springs, Maxwell, and Stanfield Upstream and Downstream Passage Improvement

Our sixth priority is to improve upstream and downstream passage at Cold Springs. Upstream and downstream passage improvements at Maxwell and Stanfield are listed as our seventh priority. Cold Springs received highest priority because Cold Springs Diversion Dam is a greater obstacle to the upstream passage of adults than Maxwell and Stanfield. Downstream passage at each screen is similar.

Small Diversions Passage Improvement

Our eighth priority is to implement projects to improve downstream passage at small diversions on the Umatilla River and Birch Creek. Among these improvements our first priority is to replace/install screens on the main stem Umatilla to protect fall chinook. Projects at Dillon and Brownell screens and the 5 unscheduled diversions on the main stem Umatilla will be completed first. Scheduled next for completion is the 11 unscreened diversions on Birch Creek to improve passage conditions for summer steelhead.

Funding of improvements at the 16 unscreened diversions on the Umatilla River and Birch Creek and Dillon and Brownell screens may be supplied by NMFS under the Columbia River Fisheries Development Program.

Habitat Improvement

Instream habitat restoration and riparian protection/rehabilitation projects are ninth in our list of priorities. Among these, we have given highest priority to projects which would benefit both spring chinook and summer steelhead. Projects in Meacham, North Fork Meacham, and Thomas creeks and South Fork Umatilla, North Fork Umatilla, and the main stem Umatilla (Meacham Creek to Forks) River will be completed by 1989. Habitat improvements in Squaw, Birch, East Fork Birch, and West Fork Birch creeks will be completed by 1990 to improve rearing conditions for summer steelhead. Habitat projects in Buckaroo and Ryan Creeks and the main stem Umatilla River (Pendleton to Meacham Creek) (other projects identified by the CTUIR, USFS, and ODFW in Table 16) will be completed after 1990.

Plan Evaluation

In this report we have identified the fishery rehabilitation and flow enhancement projects which would provide maximum fishery benefits in the basin. Achievement of fishery goals in the Umatilla will depend in part on a comprehensive evaluation program to determine the successfulness of projects. The evaluation should consist of a monitoring program such as dam counts of naturally and hatchery produced smolts and adults to measure the overall effectiveness of the rehabilitation plan. In addition, the evaluation program should include in-depth evaluations of key projects such as hatchery reintroduction/supplementation projects, upstream and downstream passage improvements at Three Mile Falls and Westland and in the channel below Three Mile Falls Dam, habitat improvements in Meacham Creek, and the Bureau of Reclamation's flow enhancement projects.

Efforts to define and develop evaluation plans and costs are underway. A BPA-funded evaluation was done on passage improvements made in the lower Umatilla River channel during FY 1984. The ODFW (Lindsay 1985) has completed a draft of a plan to evaluate habitat improvement projects in Columbia River tributaries including the Umatilla. Upon review and acceptance of evaluation plans, they will be addended to the Umatilla Rehabilitation Plan.

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Appendix A. **Recommended minimum stream flows for fish life, Umatilla Basin (ODFW 1973)**

Stream	Location	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Willow Creek	Mouth	30	30	30	30	30	--	--	--	8	--	--	--
Rhea Creek	Mouth	15	15	15	15	15	--	--	--	4	--	--	--
Umatilla River	Below McKay Creek	250	300	300	300	300	200	120	85	85	85	250	250
Umatilla River	Below Meacham Creek	200	240	240	240	240	200	100	60	60	60	200	200
Umatilla River	Below Forks	60	91	91	91	97	60	40	40	40	25	25	60
Birch Creek	Below Forks	20	30	30	30	30	21	12	8	8	8	8	20
W. Fk. Birch Creek	Below Owings Creek	20	24	24	24	24	20	10	5	5	5	5	20
Bridge Creek	Mouth	7	7	7	7	7	--	--	--	1	--	--	--
Stanley Creek	Mouth	6	6	6	6	6	--	--	--	1	--	--	--
E. Fk. Birch Creek	Below Pearson Creek	20	20	28	28	28	20	12	5	5	5	5	20
Pearson Creek	Mouth	18	18	18	18	18	--	--	--	--	--	--	--
McKay Creek	Below North Fork	30	50	80	80	80	50	30	15	15	15	15	15
McKay Creek	Below Johnson Creek	15	30	45	45	45	30	15	8	8	8	8	8
N. Fk. McKay Creek	Below Lost Pin Creek	10	25	42	42	42	25	10	5	5	5	5	5
Johnson Creek	Mouth	25	25	25	25	25	--	--	--	--	--	--	--
Squaw Creek	Below Little Squaw Creek	20	21	21	21	21	20	12	4	4	4	4	20
Meacham Creek	Below North Fork	80	120	120	120	120	80	50	25	25	25	25	80
Meacham Creek	Below East Fork	40	60	60	60	60	40	25	10	10	10	10	40
Camp Creek	Mouth	11	11	11	11	11	--	--	--	--	--	--	--
N. Fk. Meacham Creek	Below Bear Creek	40	10	10	10	10	40	25	10	10	10	10	40
N. Fk. Umatilla River	Below Coyote Creek	25	40	40	40	40	25	25	25	25	12	12	25
S. Fk. Umatilla River	Below Thomas Creek	30	58	58	58	58	30	30	30	30	15	15	10
S. Fk. Umatilla River	Below Shimmieborn Creek	25	35	35	35	35	25	25	25	25	12	12	25
Buck Creek	Mouth	16	16	16	16	16	--	--	--	2	--	--	--
Thomas Creek	Below Spring Creek	15	25	25	25	25	15	8	3	3	3	3	15

Appendix 6

Unscreened irrigation diversions in the Umatilla drainage
(from CTUIR 1984)

1) Property Owner - Ramos (Wilson Ditch); Users: Ramos, Snow, Peale
Stream - Umatilla River RM 29.0
Location - T3N, R29E, Set 22 SW of SE
Diversion Method - Small gravel dike diverts water into open ditch
Flow Control Method - None on main ditch; weir boards of flood ditches
Water Distribution Method - Main ditch (3-4 ft wide) carries water to smaller flood ditches; Ramos supplies by pipe from main ditch which passes under feed canal
Water Used For - Flood irrigation
Presently Used - Yes, l-3 cfs

2) Property Owner- Holeman (Cuhna Ditch)
Stream - Umatilla River RM 30.0
Location - T3N, R29E, Set 27 SE of NE
Diversion Method - Gravel dike extends half-way across river
Flow Control Method - None on main ditch (4-5 ft wide) which returns to river; weir boards control flow to irrigation ditches off main ditch
Water Distribution Method - Open ditches
Water Used for - Flood irrigation
Presently Used - Yes, 2-3 cfs

3) Property Owner - Brown's Dairy
Stream - Umatilla River RM 47.0
Location - T2N, R31E, Set 14 NW of NE
Diversion Method - Rip-rap dike 3/4 across river
Flow Control Method - Open ditch (5 ft wide) supplies flood ditches; unused water returns to river
Water Distribution Method - Open ditch (5 ft wide) supplies flood ditches; unused water returns to river
Water Used for - Flood irrigation
Presently Used - Yes, .5 cfs; present contract for McKay storage is 350 acre-feet

4) Property Owner - Johns, Smith, Beamer
Stream - Umatilla River RM 48.8
Location - T2N, R31E, Set 13 NE of NE
Diversion Method - Unknown
Flow Control Method - Unknown
Water Distribution Method - Open ditch
Water Used for - Formerly used for irrigation of dairy pasture
Presently Used - No, irrigation water now pumped out of Birch Creek; ditch may be used again in future

5) Property Owner - Conrad Wyss
Stream - Umatilla River RM 50.0
Location - T2N, R32E, Set 7 NE of SE
Diversion Method - Rip-rap dike l/2 across river, gravel dike extends 100 yards upstream

Flow Control Method - Hinged metal gate valve on 3 ft culvert at point of diversion; another similar valve and culvert 1/4 mile down ditch
Water Distribution Method - Open ditch (4-5 ft wide) supplies flood ditches
Water Used for - Flood irrigation
Presently Used - Yes, 1-2 cfs; present contract for McKay Storage is 400 acre-feet

6) Property Owner - L. Spiess (Crispin Ditch); Users: Spiess, L. Telford, J. Knepp, C. Hunt
Stream - Umatilla River RM 57.0
Location - T2N, R33E, Set 7 NE1/4
Diversion Method - Gravel berm in main stem diverts water into a north side channel; 4-5 ft. concrete dam across side channel (1 mi. from berm) backs water into open ditch; undiverted water returns to river
Flow Control Method - Headgate just above dam
Water Distribution Method - 3 ft. wide concrete flume carries water to network of smaller open ditches
Water Used For - Flood irrigation and possibly livestock watering
Presently Used - Yes, irrigation for 75 acres

7) Property Owner - Warren Taylor (Johns, Smith and Beamer Ditch)
Stream - Birch Creek RM 0.3
LOCIation - T2N, R31E, Set 13 NW of SE
Diversion Method - 3 ft. concrete dam, 3-step fish ladder on west side
Flow Control Method - Wooden left gate on west side of dam
Water Distribution Method - Water flows 200 yds. down ditch to pump station - water not pumped to sprinkler system is returned to Birch Creek
Water Used For - Sprinkler irrigation 422 acres
Presently Used - Yes, water right 9.55 cfs

8) Property Owner - Russell Kuhn
Stream - Birch Creek RM 2.8
Location - T2N, R32E, Set 30 NE of NE
Diversion Method - 3-4 ft. dam, no fish ladder (possible passage problem)
Flow Control Method - Metal lift gate on east side of dam
Water Distribution Method - Water flows 100 yds. down ditch, through a pipe above Birch Creek then into flood ditches
Water Used For - Flood irrigation - 85 acres
Presently Used - Apparently not in last year or two, water right 2.12 cfs

9) Property Owner - Jim Straughan
Stream - Birch Creek RM 4.8
Location - T2N, R32E, Set 33 SW of NW
Diversion Method - Metal lift gate, boulders in creek buck up water into ditch
Flow Control Method - Metal lift gate
Water Distribution Method - Water flows through ditch through sprinkler irrigated field to several ditches in flood irrigated field
Water Used For - Flood irrigation 87 acres
Presently Used - Yes, water right 2.03 cfs

10) Property Owner - J. Elridge and J. Hummell
Stream - Birch Creek RM 10.2
Location - T1N, R32E, Set 22 NW of SE
Diversion Method - Concrete dam across creek (2 ft. water drop)
Flow Control Method - Old gate valve (crank raise) just above dam
Water Distribution Method - Open ditch, 3 ft. wide
Water Used For - Flood irrigation
Presently Used - Yes, .5 cfs

11) Property Owner - Gambill Users: Hemphill and Condra
Stream - Birch Creek RM 14.5
Location - T1S, R32E, Set 4 NW of SE
Diversion Method - Concrete dam across creek (2 ft. water drop)
Flow Control Method - Hand operated gate valve just above dam
Water Distribution Method - Concrete flume 4 ft. wide 50 yds. long then open ditch for another 1/2 mile
Water Used For - Flood irrigation
Presently Used - Yes, 2-3 cfs

12) Property Owner - Louisiana Pacific; Users: Chapman, Weinke, McGowan, Markle
Stream - Birch Creek RM 16.0
Location - T1S, R32E, Set 9 SW of SW
Diversion Method - 8-10 ft. concrete dam, 4-step fish ladder on east side
Flow Control Method - Old wooden gate valve just above dam
Water Distribution Method - Open ditch (4 ft. wide)
Water Used For - Flood irrigation
Presently Used - Yes, 1-2 cfs

13) Property Owner - Helen Sherrill; Possible Users: H. Sherrill, C. Cummiskey, E. Britt, M. Adkinson
Stream - East Birch Creek RM 2.1
Location - T1S, R32E, Set 28 NW 1/4
Diversion Method - Gravel dike half-way across creek
Flow Control Method - Vertical hand operated gate valve
Water Distribution Method - Open ditch (2-3 ft. wide and 1 mi. long); water also pumped from just above headgate
Water Used For - Livestock watering and possible irrigation
Presently Used - Yes, 1 cfs

14) Property Owner - L. Cortazar
Stream - East Birch Creek RM 7.2
Location - T2S, R32E, Set 11 SW 1/4
Diversion Method - Small gravel dike diverts into ditch (2 ft. wide)
Flow Control Method - Unknown
Water Distribution Method - Open ditch 1/4 mi. to pond where water is pumped
Water Used For - Sprinkler irrigation
Presently Used - Yes, 1 cfs

15) Property Owner - Cunningham; User: A.H. Ranches, Inc.
Stream - W. Birch Creek RM 2.5
Location - T1S, R32E, Set 19 SW 1/4

Diversion Method - 5-6 ft. dam with ladder on East Side -- too much velocity through ladder
Flow Control Method - Metal gate valve
Water Distribution Method - Open ditch, l/4 mi. to pump station across highway
Water Used For - Sprinkler irrigation from pump station
Presently Used - Yes, l-2 cfs

16) Property Owner - Ralph Hutchinson
Stream - West Birch Creek RM 1.0
Location - T1S, R32E, Set 17 SW 1 14
Diversion Method - Concrete intake wall u-shape
Flow Control Method - Metal lift gate against concrete wall
Water Distribution Method - Open ditch 2-3 ft. wide
Water Used For - Flood irrigation and pump from ditch
Presently Used - Yes, 1-2 cfs

Appendix C

Methods to Establish Fishery Rehabilitation Objectives

Natural Production

We established rehabilitation objectives for naturally produced fish from calculations of the number of adults required to achieve maximum smolt production. Where data allowed we used more than one method to verify our estimation of production potential.

Summer Steelhead

Results of two methods to determine rehabilitation objectives for summer steelhead are shown in Table C-l. The average of our two estimates was used in subsequent calculations of fishery benefits using the life history model (Appendix 0). A description of both methods is given below.

1. IFIM/Steelhead Standing Crop Model

Production estimates for enhanced flows of the CRP/Meacham Dam Plan were calculated by NMFS (1984) from steelhead standing crop data measured in the John Day, Grande Ronde, Deschutes and Umatilla rivers. Standing crops for age 1 (yearling) steelhead were measured in late summer and compared with a simulation model utilizing Instream Flow Incremental Methodology (VIM) (FWS 1981 and unpublished data). The IFIM was developed by the FWS (see Bovee and Cochnauer 1977 and Bovee and Milhouse 1978) to predict changes in physical habitat for fish under varying flow conditions. Data inputs include stream depth, water velocity, and gravel size composition. As flows change, the model estimate For each combination of depth, velocity, and substrate in a study reach the probability of use by each species and life stage under investigation. Output from the IFIM program is Weighted Useable Area (WUA), an approximate measure of a habitat's carrying capacity based on physical conditions alone.

Table C-1. Estimates of numbers of adult summer steelhead needed for maximum smolt production in the Umatilla River. Two methods were used to derive an average estimate.

		Enhanced Flows		
			Long Term Projects[a/]	Interim Project[b/]
Method	Existing Flows	CRP Plan	CRP/Meacham Dam Plan	McKay Storage Plan
IFIM/steelhead standing crop model	1,988	1,988	2,804	1,988
Steelhead smolt production/ flow regression	1,773	1,773	2,914	1,773
Average Estimate	1,881	1,881	2,859	1,881

a/ Projects are potential long term solutions to the basin's fishery problems.
b/ Project would be used as an interim measure to enhance flows until the CRP or CRP/Meacham Dam Plans are implemented.

To correlate these physical measurements with fish production, NMFS developed regressions of steelhead standing crop on WUA:

$$y = 1.230\,(x) + 1{,}600 \qquad \text{Natural Riparian}$$

$$y \; q \; 0.614\,(x) + 354 \qquad \text{Degraded Riparian}$$

where y = total steelhead biomass (grams/1,000 ft^2) x 1,000

x = weighted useable area per 1,000 feet of stream

We used these regressions to estimate the increase in production of yearling steelhead in Meacham Creek during late summer that would result from increased summer flows by Meacham Creek Dam. It was assumed that the higher summer flows by Meacham Creek Dam would not enhance steelhead production in the mainstem below the confluence of Meacham Creek, since it is anticipated that water temperatures will reach sub-optimal levels for growth at the mouth of Meacham Creek.

The average spawning escapement of adults during the 1960's and early 1970's (1988) (ODFW 1973) was used as our estimate of number of adults required for maximum smolt production under existing flows. The increase in number of smolts due to the CRP/Meacham Dam Plan was calculated to be 22,044. We derived the number of smolts by using a 41.3% yearling to smolt survival rate (Shapovalov and Taft 1954). We assumed that all yearling (age 1) fish captured would migrate to the sea the following year at age 2. This seems a reasonable assumption since analysis of scales from 32 wild adult steelhead trapped at Three Mile Falls Dam in 1983 revealed that 15.7% had migrated to sea at age 1, 81.3% at age 2, and 3.0% at age 3 (unpublished data, Raymond R. Boyce, Oregon Department of Fish and Wildlife, Portland, Oregon).

We estimated 816 adults would be needed to produce the additional 22,044 smolts under the CRP/Meacham Dam Plan. This assumes a smolt production rate of 27 smolts/adult which was based on average smolt counts at Umatilla screens during 1961, 1968, 1973, and 1977 (53,767) and average spawning escapements of adults during the late 1960's and early 1970's (1988) (ODFW 1973). As will be discussed later, smolt counts in these years represented the total population.

Our estimate of number of adults to produce maximum number of smolts under the CRP/Meacham Dam Plan is therefore 816 + 1,988 = 2,804. The CRP Plan would not increase smolt production over existing flows since it would not provide any additional Sumner flows in Meacham Creek or any other headwater stream used for rearing by steelhead. The number of adults to produce maximum number of smolts under the CRP Plan would, therefore, be the same as those under existing flows (Table C-l).

Our method to estimate smolt production assumes that production is limited chiefly by rearing habitat during late summer. This assumption seems reasonable for salmonids. Marshall and Britton (1980) found significant ($P<0.05$) correlations between measures of coho smolt yield (numbers and biomass) and carrying capacity (stream length and area) in 21 streams. They hypothesized that summer flows were the critical limiting factor determining the stream's carrying capacity and number and weight of salmonid smolts ultimately produced. McIntyre (1983) found that smolt yield of wild spring chinook in Oregon, Idaho, and Washington streams were related to mean daily discharge in September (see Spring Chinook).

2. Steelhead Smolt Production/Flow Regression

We also predicted the number of smolts produced by a regression of smolts trapped at Umatilla screens during 1961, 1968, 1973, and 1977 on August and September flows averaged for the previous two years (Figure C-l). R^2 of the regression was 0.884. Correlations of smolts to flow in other months of the year resulted in lower correlations. Smolt counts during May and June (the principle months of migration) in these years represented the total population. Due to drought spring flows, all Umatilla water was diverted into irrigation ditches and all smolts were trapped and hauled to the Columbia River. The relation in Figure C-l does not include data for the 1966 drought because it did not follow the apparent trend formed by data for other years. Smolt counts in that year were lowest (22,814) even though summer flows (55 cfs) were among the highest. Smolt production in 1966 may have been substantially reduced by the severe flood that occurred in January 1965. The flood, which was the worst on record, may have caused high mortality of juveniles resulting in a poor year class of smolts in 1966.

A curvilinear regression equation in the form $y = ax^b$ was used to describe the relationship between number of smolts and flow. Marshall and Britton (1980) considered this form of a regression equation to be most appropriate to compare indices of smolt yield with rearing space for coho. We used the regression to predict numbers of smolts under existing and enhanced flows. The range of flows used to develop the regression (34-61 cfs) included values that would occur under enhanced flow conditions. Prediction of numbers of smolts under the CRP/Meacham Dam Plan assumed that the increased flows would increase smolt production only in Meacham Creek. We assumed that 40% of the

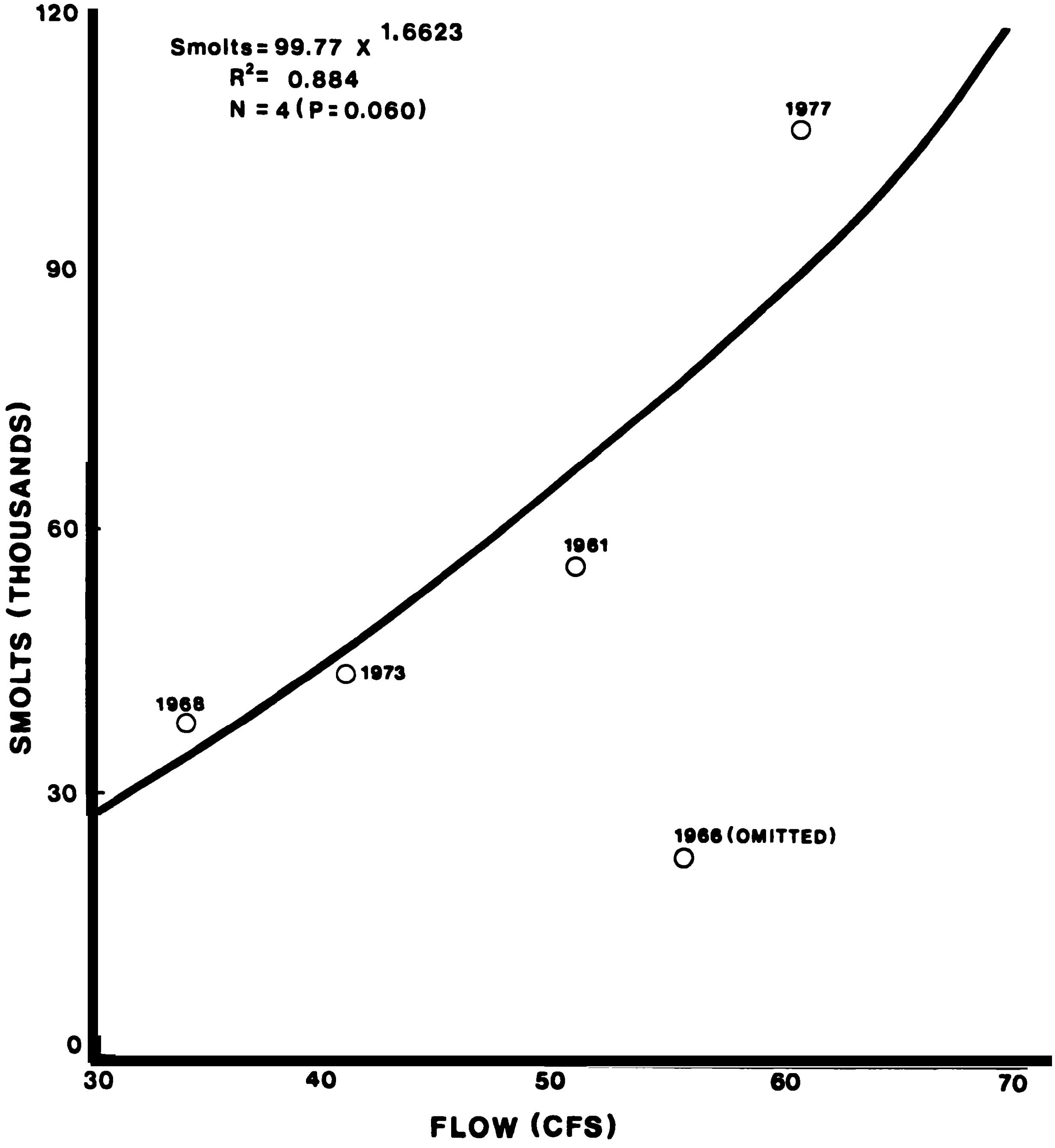

Figure C1. Relation between smolt production of summer steelhead [a/] in the Umatilla River and average August and September flow [b/].

a/ Smolt counts at Umatilla River screens. Years included had complete counts in May and June, the principle months of migration.

b/ Data for the USGS station at Pendleton (Rm 55.2), averaged for two previous years.

basin's population spawn and rear in Meacham Creek (ODFW 1973). We used a smolt production rate of 27 smolts/adult to determine the number of adults required to produce the maximum number of smolts. The CRP and McKay Storage Plans would not provide any additional summer flows Meacham Creek or any other headwater stream used for rearing by steelhead. Therefore, production estimates would be the same as under existing flows (Table C-1).

There are a few potential problems with the flow regression model. First, the small number of years of data used in the regression (4) may limit its predictive accuracy. In addition, as for the IFIM/Steelhead Standing Crop Model, this method assumes that production of steelhead is chiefly limited by available rearing habitat during August and September low flows. It is apparent from the above discussion that other factors (such as the severe flood of 1965) can become limiting. In these years, rehabilitation objectives based on summer flows may not be attainable.

Fall Chinook

1. Available Spawning Area Method

We estimated numbers of adult fall chinook needed to achieve maximum smolt production based on available spawning habitat. This resulted in adult production objectives of 11,097 for existing flows, 10,890 adults for the CRP Plan, 11,403 adults for the CRP/Meacham Dam Plan, and 11,097 for the McKay Storage Plan.

CTUIR (1984) estimated fall chinook production potential utilizing data from spawning gravel surveys (ODFW 1966), instream flow studies (FWS 1981), stream discharge records (BR 1983), and salmonid spawning area studies (Burner 1951). CTUIR (1984) used the following data and methods:

1) Amount of good spawning gravel from the mouth of the Umatilla River to the North and South Forks was listed for each of eight IFIM flow reaches modeled by FWS in 1981.

2) Existing and enhanced flows for November, the peak spawning month for fall chinook, were calculated for each study reach.

3) Weighted Useable Area (WUA) for fall chinook spawning for each stream section were derived from IFIM tables under existing and enhanced flows. This WUA was compared to the highest WUA (at! optimum discharge) which was assumed to equal estimates of total "good" spawning habitat surveyed by ODFW. The WUA under existing or enhanced flows divided by the maximum WUA equals the percentage of wetted habitat. The useable yards of spawning gravel for each reach equals spawning gravel multiplied by the percentage of wetted habitat. The useable yards were sumned for all reaches to obtain total useable yards of spawning gravel.

4) Spawning area required by fall chinook (24.4 yds^2/pair) (Burner 1951) was divided into the total useable gravel to yield the number of spawning adults under fully seeded conditions.

Data used for these calculations are shown in Table C-2.

Natural production potential is similar between existing (11,097) and enhanced flows of the CRP/Meacham Dam (11,403) and CRP Plans (10,890) because nearly 85% of the spawning gravel for fall chinook is located in the Upper Umatilla above McKay Creek. During November this area would not be affected by flow increases provided by the Columbia River Pumping (CRP)/Meacham Dam Plan or the CRP Plan below McKay Creek. In addition, improved flows from either plan would increase total useable spawning gravel in about half of the stream sections affected by the projects. Useable spawning gravel in other sections are likely to decrease, because stream depths and velocities over the spawning gravel in these areas would become less optimal at greater flows. For example, IFIM modeling predicted that flow increases provided by the CRP/Meacham Dam Plan would increase the total useable yards for fall chinook spawning in lower Meacham Creek (mile 0.0-15.0) and from Pendleton to Squaw Creek (mile 54.9-74.9) in the mainstem Umatilla, but would decrease the total useable yards from McKay Creek to Pendleton (mile 48.9-54.9). Below McKay Creek in the mainstem, flow increases from the CRP/Meacham Dam Plan would increase useable yards from Birch Creek to McKay Creek (mile 46.5-48.9), but would decrease useable yards from Feed Canal to Birch Creek (mile 28.8-46.5) and from Three Mile Falls Dam to Feed Canal (mile 3.0-28.8). The total effect would be a slight increase in useable yards and spawning potential under the enhanced flows. The McKay Storage Plan would not provide any additional flow during November so the production estimate would be the same as under existing flows.

Table C-2. Total useable yards and calculation of natural production potential of fall chinook in the Umatilla River (from CTUIR 1984 and NMFS 1984).

Study Reach	River Miles	Good Spawning Gravel (yds²)[a]	Existing Flows: Ave. Nov. Flow (cfs)	Existing Flows: Percent Wet. Habitat[b]	Existing Flows: Total Useable (yds²)[c]	CRP/Meacham Dam Plan: Ave. Nov. Flow (cfs)	CRP/Meacham Dam Plan: Percent Wet. Habitat[b]	CRP/Meacham Dam Plan: Total Useable (yds²)[c]	CRP Plan: Ave. Nov. Flow (cfs)	CRP Plan: Percent Wet. Habitat[b]	CRP Plan: Total Useable (yds²)[c]
Mouth to Three Mile Falls Dam	0.0- 3.0	0	224	0	0	440	0	0	423	0	0
Three Mile Falls Dam to Feed Canal	3.0-28.8	4,180	158	100	4,180	375	92	3,846	360	86	3,598
Feed Canal to Birch Creek	28.8-46.5	11,925	153	100	11,925	360	64	7,632	347	64	7,632
Birch Creek to McKay Creek	46.5-48.9	8,398	257	64	5,375	359	94	7,894	343	92	7,726
McKay Creek to Pendleton	48.9-54.9	4,850	242	67	9,950	261	55	8,168	242	67	9,950
Pendleton to Squaw Creek	54 9-74.9	86,285	239	92	79,382	253	100	86,825	239	92	79,382
Squaw Creek to Meacham Creek	74.9-77.1	1,855	221	97	1,796	238	95	1,762	221	97	1,796
Meacham Creek to Forks	77.1-87.9	31,114	131	71	22,091	131	71	22,091	131	71	22.091
Meacham Creek	0.0-15.0	1,750	86	39	683	100	51	893	86	39	683
	TOTALS	160,357			135,382			139,111			132,858
Production potential (total useable yds² ÷ 24.4 yds² per spawning pair)					11,097			11,403			10,890

a Spawning habitat surveyed by ODFW (1966).
b USGS (40-50 yr averages) flows compiled by BR (1983).
c Total useable gravel based on IFIM study and average flows for November.

Estimates of adult production from available spawning habitat assume the highest WUA is equal to the total good spawning habitat surveyed by ODFW. In addition, we assumed the amount of wetted spawning gravel in November determines production potential of fall chinook. Available data indicate that most fall chinook juveniles will migrate from the Umatilla prior to the low flow months of Sumner. Rearing area, however, could be a significant factor during years of low spring flow.

2. Ratio of Spawners to Spawning Area Method

For comparative purposes, we determined spawning potential of fall chinook using another method. However, we did not use this estimate to establish rehabilitation objectives, since production estimates for the enhanced flows could not be made with the method.

Spawning potential of fall chinook in the Umatilla was estimated by the ratio:

$$1)\quad \frac{\text{Spawning potential of ChF in the Umatilla River}}{\text{Total ChF Spawning Area}} = \frac{\text{ChF spawners in the Deschutes River}}{\text{Total ChF Spawning Area}}$$

$$a\quad \frac{x}{160{,}357\ \text{yds}^2} = \frac{10{,}619}{123{,}444\ \text{yds}^2}$$

Solving for x, we estimate 13,794 adults as the spawning potential under present flow conditions.

Fall chinook spawning area data (total yds^2 of good spawning gravel) are from ODFW surveys in the Umatilla (ODFW 1966) and Deschutes (Aney et al. 1967) Rivers. The number of spawners in the Deschutes are from Lindsay et al. (1982) and represents the average escapement of jacks and adults for the years 1977-32 (range = 7,793 to 12,132).

This method assumes that the average escapement in the Deschutes River during 1977-82 represents full seeding of adults. This assumption is probably valid since the predicted escapement of fall chinook at full seeding in the Deschutes (123,444 yds^2:24.4 yds^2 per spawning pair = 10,118 adults) is similar to the observed average escapement during 1977-82 (10,619 adults).

The higher spawning potential estimate from this method (13,794) suggests that estimates by the CTUIR (1984) method (10,890 to 11,097 adults under existing and the enhanced flows) may be conservative.

Spring Chinook

We estimated numbers of adult spring chinook needed to achieve maximum smolt production based on available rearing habitat versus production models. This resulted in adult production objectives of 582 adults for existing flows, 552 adults for the CRP Van, and 1,166 adults for the CRP/Meacham Dam Plan, and 532 adults for the McKay Storage Plan.

The FWS (McIntyre 1983 and 1985) have developed regressions between smolt yield (Sm) of yearling migrants of spring chinook in the Warm Springs River, John Day River, and Lookingglass Creek in Oregon, the Lemhi River in Idaho, and the Yakima River in Washington and two indices of available habitat:

1) Mean daily discharge (cfs) in September

$$Sm = 102{,}186.65 \ln (cfs/57) + 7{,}330$$

2) Stream length (km)

$$Sm = 130.74 L^{1.43}$$

The FWS have shown that predictions are more accurate using the stream length model. We could not use the stream length regression to determine production at the varying flows so we used the flow regression to predict number of smolts at each of the flows and calibrated predictions with the stream length regression. Predictions of smolt numbers under CRP/Meacham Dam flows were done assuming 40% of the population spawned and reared in Meacham Creek.

We used a smolt production rate of 75 smolts/adult to back-calculate numbers of adults required to produce number of smolts. This production rate was derived using fecundity (4,000 eggs/female) and egg-to-smolt survival (5.5% data of spring chinook in the John Day River (Knox et al. 1984) and adults/redd data of spring chinook in the Warm Springs River (3 fish/redd) (unpublished data, Chris Stainbrook, Warm Springs Confederated Tribes, Warm Springs, Oregon).

The CRP Plan would not provide any additional summer flows in Meacham Creek or any other headwater tributary used for rearing by spring chinook. Therefore, production estimates would be the same as under existing flows.

The regression models are subject to the following assumptions and limitations:

1) Juveniles are assumed to spend one year in fresh water and migrate to sea in March as yearlings.

2) Similar to the IFIM/Steelhead Standing Crop Model and the Steelhead Smolt Production/Flow Regression methods, available rearing habitat is assumed to limit production of spring chinook.

3) Inherent in the models is the assumption that all streams used in the regression had the same productivity and were fully seeded by juveniles. Production potential in the Umatilla is assumed similar to these streams.

Hatchery Production

Production objectives for hatchery production of fall and spring chinook were based on adult production goals established by CTUIR and ODFW (CTUIR 1984). Hatchery objectives for summer steelhead were based on number of adults expected to return from future hatchery releases. Production objectives are reported in Table [illegible].

Summer Steelhead

Projected returns of summer steelhead adults were estimated by applying a 2.7% survival rate to the 200,000 smolts that are planned for release from Bonifer and Minthorn Springs facilities. This survival rate was calculated from the average survival rate of steelhead at Round Butte Hatchery on the Deschutes River (4.0%) (Olsen et al. 1984) and adjusting this survival rate down 32% to account for additional mortality of smolts and adults over John Day Dam (Raymond 1979; Gibson et al. 1979). We do not have survival data for the

Umatilla to provide a more direct estimate of adult returns. This method yields an estimated 5,400 adult steelhead returning to collection facilities before in-river harvest.

Fall Chinook

An CTUIR/ODFW production goal of 10,000 adult fall chinook was used as our hatchery production objective for the Umatilla Basin. We estimate current releases of 225,000 upper river bright yearlings must be supplemented with releases of 2,958,350 upper river bright fingerlings to achieve the goal of 10,000 acults. This assumes 0.5 and 0.3% survival rates for yearling and fingerling releases, respectively. Survival data for yearlings were derived from 1979 and 1980 brood upper river brights released and recovered at Bonneville Hatchery (Hansen 1983 and unpublished data). Survival data for fingerlings are from 1575-77 brood upper river brights released and recovered at Priest Rapids Hatchery (unpublished data of Bob Foster, Washington Department of Fisheries, Olympia, Washington). Survival rates of yearlings and fingerlings were adjusted to account for mortality of smolts and adults over Bonneville, The Dalles, and John Day dams (Raymond 1979; Gibson et al. 1979).

Spring Chinook

CTUIR/ODFW production goal for spring chinook is set at 10,000 adults. We estimate 1,666,667 yearlings must be released to achieve this goal assuming a 0.6% survival rate. This survival rate was estimated from the survival rate of 1979 brood soring chinook yearlings at Round Butte Hatchery (0.9%)

(unpublished data, Randy Robart, Oregon Department of Fish and Wildlife, Madras, Oregon). We decreased this rate by 32% to account for additional mortality of smolts and adults over John Day Dam (Raymond 1979; Gibson et al. 1979). The survival data from Round Butte are from a single brood and may not be representative of the Umatilla. However, preliminary return data for later broods at Round Butte indicates that survival was also 0.9-1.0% each year.

Appendix D

Methods to Determine Fishery Benefits From Rehabilitation Projects

In this section we describe the details of our calculation of fishery benefits for each of the four rehabilitation projects evaluated (upstream passage improvement, downstream passage improvement, adult and smolt trucking, and habitat improvement) and for each of four flow conditions (existing, CRP Plan, CRP/Meacham Dam Plan, and McKay Storage Plan). The effects of each rehabilitation project and flow regime on each life history stage in the life history model are described below. In Appendix E we have provided two examples of calculations of fishery benefits for both naturally and hatchery produced salmonids.

Flow Enhancement

Fishery benefits of flow enhancement projects were evaluated over the following four life stages in the life history models (Figures 18 and 19).

Adults at Mouth

For natural production, we began the evaluation process with the number of adults required for maximum smolt production (Table 21). This number of adults will vary with available habitat, which in turn varies with flows provided by the proposed flow enhancement projects.

Adults Entering River

Flow enhancement effects the number of adults entering the river. Peak numbers of fall chinook will arrive at the mouth of the Umatilla mid-September; however, due to naturally low flows during fall months, adults would not be able to enter the river until November, shortly before they spawn. Because of this delay, we estimate there will be a 25% loss in production of fall chinook under existing flows. Loss of chinook could be much greater, however, during years of low flow. This loss in production will result from spawning before adults reach spawning areas of the Umatilla and increased adult mortality due to the delay. Since the CRP/Dam Creek and CRP Plans would provide adequate flows for upstream passage during fall months (beginning September 16), no losses were projected under these flows.

Adults Surviving to Spawn

Flow enhancement affects the survival of adults over upstream passage obstructions. See Upstream Passage Improvement for a discussion of methods used.

Smolts Surviving to Lower River

Flow enhancement affects survival of smolts to the lower river at screened and unscreened diversions and survival in the lower channel. See Downstream Passage Improvement and Adult and Smolt Trucking, respectively, for the methods used.

Upstream Passage Improvement

Fishery benefits of upstream passage improvement projects to naturally and hatchery produced salmonids were determined using adult upstream passage data calculated with and without passage improvements (Table D1), 44-year flow distribution data (Table D2-D5), and migration timing data of adults (Table D6). Estimates of passage of adults at each obstruction for each flow category were based on field observations of biologists of the fish and wildlife agencies. There are no published data for passage at these obstructions. Maxwell, Cold Springs, and Westland diversion dams were considered barriers to upstream passage of adults at flows less than 100-200 cfs. Flows up to 300 cfs were assumed to limit passage. With the irrigation dam boards up (June-October), we assumed Stanfield Diversion Dam is a barrier to adults at flows less than 200 cfs with limited passage at flows of less than 300 cfs. With the irrigation dam boards down (November-May), we assumed passage at Stanfield is similar to Maxwell and Cold Springs. With completion of passage improvements, we estimated 100% passage at flows greater than 50 cfs at Maxwell, Cold Springs, Westland, and Stanfield.

We estimated 95% passage at Three Mile Falls Dam, for flows 50-500 cfs. At higher flows, however, passage is assigned to be reduced by a false attraction problem created by increased spill over the crest of the dam. With passage improvement, we estimated 95% of the adults could pass at flows greater than 50 cfs.

Table D1. Estimated passage (expressed as percentage of fish passing) of adult salmonids in the Umatilla under varying flows.

Obstruction	Condition				
Channel below Three Mile Falls Dam	Without Passage Improvement	< 200 cfs	200-300 cfs	> 300 cfs	
		0%	80%	100%	
	With Passage Improvement	< 100 cfs	100-150 cfs	> 150 cfs	
		0%	80%	100%	
Three Mile Falls Dam	Without Passage Improvement	< 50 cfs	50-500 cfs	500-750 cfs	> 750 cfs
		0%	95%	75%	50%
	With Passage Improvement	< 50 cfs	> 50 cfs		
		0%	95%		
Maxwell and Cold Springs Diversion Dams	Without Passage Improvement	< 100 cfs	100-150 cf	> 150 cfs	
		0%	80%	100%	
	With Passage Improvement	< 50 cfs	> 50 cfs		
		0%	100%		
Westland Diversion Dam	Without Passage Improvement	< 200 cfs	200-300 cf	> 300 cfs	
		0%	80%	100%	
	Without Passage Improvement	< 50 cfs	> 50 cfs		
		0%	100%		
Stanfield Diversion Dam	Without Passage Improvement: Irrigation Dam Boards Up (June-October)	< 200 cfs	200-300 cf	> 300 cf	
		0%	80%	100%	
	Irrigation Dam Boards Down (November-May)	< 100 cfs	100-150 cfs	> 150 cfs	
		0%	80%	100%	
	With Passage Improvement	50 cf	50 cf		
		0%	100%		
Channel between Maxwell and Westland Diversion Dams		< 150 cfs	150-250 cfs	> 250 cfs	
		0%	80%	100%	

Table D2. Distribution of average monthly flows (expressed as percentage of years out of 44 years during 1935-18) during October-June for present flow conditions. Flow data was provided by the Bureau of Reclamation.

Obstruction	Month	< 100 cfs	100-150 cfs	> 150 cfs	< 200 cfs	700-300 cfs	> 300 cfs
Channel below Three Mile Falls Dam	October	75.0	11.4	13.6	95.9	2.3	1.8
	November	11.4	77.3	61.3	65.9	13.6	20.5
	December	6.8	13.6	79.6	31.8	11.4	56.8
	January	4.6	6.8	88.6	18.7	13.6	68.3
	February	2.3	6.8	90.9	13.6	9.1	77.3
	March	0.0	4.6	95.4	9.1	4.6	86.3
	April	6.8	2.3	90.9	9.1	4.6	86.3
	May	72.7	4.6	73.7	31.8	6.8	61.4
	June	75.0	4.6	70.4	81.8	9.1	9.1

Obstruction	Month	< 50 cfs	> 50 cfs	50-500 cfs	500-750 cfs	> 750 cfs
Three Mile Falls Dam	October	51.3	47.7	47.7	0.0	0.0
	November	4.6	95.4	86.4	6.8	7.3
	December	0.0	100.0	61.4	11.4	77.7
	January	0.0	100.0	47.7	13.6	38.7
	February	0.0	100.0	31.8	13.6	54.6
	March	0.0	100.0	22.1	18.7	59.1
	April	6 8	93.7	9.1	13.6	70.5
	May	70.5	79.5	34.1	15.9	29.5
	June	59.1	40.9	36.4	2.3	7.3

Obstruction	Month	< 100 cfs	100-150 cfs	> 150 cfs
Maxwell Diversion Dam	October	88.6	4.6	6.8
	November	61.4	9.1	79.5
	December	75.0	9.1	65.9
	January	15.9	6.8	77.3
	February	4.6	6.8	88.6
	March	0.0	4.6	95.4
	April	6.8	0.0	93.3
	MaY	25.0	7.3	13.7
	June	77.7	4.6	77.7

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Table D2. (Continued)

Obstruction	Month	< 200 cfs	200-300 cfs	> 300 cfs
Westland Diversion Dam	October	95.8	4.2	0.0
	November	81.8	6.8	11.4
	December	43.2	6.8	50.0
	January	31.8	13.6	54.6
	February	18.2	9.1	72.7
	March	9.1	4.6	86.3
	April	6.8	2.3	90.9
	May	29.5	6.8	63.7
	June	79.5	9.1	11.4
		< 100 cfs	100-150 cfs	> 150 cfs
Cold Springs Diversion Dam	October	81.8	6.8	11.4
	November	72.7	6.8	20.5
	December	27.3	4.6	68.1
	January	15.9	6.8	77.3
	February	4.6	6.8	88.6
	March	0.0	0.0	100.0
	April	0.0	2.3	97.7
	May	0.0	2.3	97.7
	June	0.0	2.3	97.7
Stanfield Diversion Dam	Irrigation Dam Boards Up			
		< 200 cfs	200-300 cfs	> 300 cfs
	October	93.2	6.8	0.0
	June	4.6	43.2	52.2

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Obstruction	Irrigation Dam Boards Down	< 100 cfs	100-150 cfs	> 150 cfs
Stanfield Diversion Dam	November	29.5	18.2	52.3
	December	18.2	2.3	79.5
	January	2.3	6.8	90.9
	February	0.0	2.3	97.7
	March	0.0	0.0	100.0
	April	0.0	0.0	100.0
	May	0.0	2.3	97.7
	Month	**< 150 cfs**	**150-250 cfs**	**> 250 cfs**
Channel between Maxwell and Westland Diversion Dams	October	95.8	4.2	0.0
	November	75.0	13.6	11.4
	December	38.6	6.8	54.5
	January	25.0	13.6	61.4
	February	13.6	9.1	77.3
	March	4.6	6.8	88.6
	April	6.8	2.3	90.9
	May	25.0	9.1	65.9
	June	75.0	9.1	15.9

Table D3. Distribution of average monthly flows (expressed as percentage of years out of 44 years during 1935-78) during October-June for enhanced flows as provided by the CRP Plan. Flow data was provided by the Bureau of Reclamation.

Obstruction	Month	< 100 cfs	100-150 cfs	> 150 cfs	> 200 cfs	200-300 cfs	> 300 cfs
Channel below Three Mile Falls Dam	September[a]	0.0	4.6	95.4	9.1	88.6	2.3
	October	0.0	2.3	97.7	2.3	63.6	34.1
	November	0.0	6.8	93.2	11.4	15.9	72.7
	December	0.0	6.8	93.2	13.6	9.1	77.3
	January	0.0	2.3	97.7	4.6	9.1	86.3
	February	0.0	2.3	97.7	2.3	4.6	93.1
	March	0.0	0.0	100.0	0.0	9.1	90.9
	April	2.3	4.6	93.1	6.8	0.0	93.2
	May	0.0	4.6	95.4	6.8	38.6	54.6
	June	6.8	15.9	77.3	36.4	45.5	18.1

Obstruction	Month	< 50 cfs	> 50 cfs	50-500 cfs	500-750 cfs	> 750 cfs
Three Mile Falls Dam	September[a]	0.0	100.0	100.0	0.0	0.0
	October	0.0	100.0	97.7	2.3	0.0
	November	0.0	100.0	77.3	13.6	9.1
	December	0.0	100.0	65.9	13.6	20.5
	January	0.0	100.0	56.8	13.6	29.6
	February	0.0	100.0	29.5	11.4	59.1
	March	0.0	100.0	20.5	18.2	61.3
	April	0.0	100.0	18.2	15.9	65.9
	May	0.0	100.0	54.5	15.9	29.6
	June	4.6	95.4	90.9	6.8	2.3

Obstruction	Month	< 100 cfs	100-150 cfs	> 150 cfs
Maxwell Diversion Dam	September[a]	0.0	20.5	79.5
	October	0.0	11.4	88.6
	November	4.6	9.1	86.3
	December	2.3	9.1	88.6
	January	2.3	2.3	95.4
	February	0.0	2.3	97.7
	March	0.0	0.0	100.0
	April	2.3	2.3	95.4
	May	0.0	6.8	93.2
	June	29.5	15.9	54.6

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Table D3. (Continued)

Obstruction	Month	< 200 cfs	200-300 cfs	> 300 cfs
Westland Diversion Dam	September[a]	47.7	50.0	2.3
	October	25.0	59.1	15.9
	November	25.0	31.8	43.2
	December	20.5	36.4	43.1
	January	13.6	40.9	45.5
	February	2.3	25.0	72.7
	March	0.0	6.8	93.2
	April	6.8	0.0	93.2
	May	6.8	34.1	59.1
	June	56.8	22.7	20.5
		< 100 cfs	100-150 cfs	> 150 cfs
Cold Springs Diversion Dam	September[a]	0.0	13.6	86.4
	October	0.0	6.8	93.2
	November	9.1	9.1	81.8
	December	6.8	6.8	86.4
	January	2.3	6.8	90.9
	February	0.0	2.3	97.7
	March	0.0	0.0	100.0
	April	0.0	0.0	100.0
	May	0.0	0.0	100.0
	June	0.0	2.3	97.7
Stanfield Diversion Dam	Irrigation Dam Boards Up			
		< 200 cfs	200-300 cfs	> 300 cfs
	September[a]	29.5	47.7	22.8
	October	11.4	70.5	18.1
	June	2.3	22.7	75.0

(Continued next page)

Table 3

Obstr t

g B

		< 100 cfs	100-150 cfs	> 150 cfs
Stanfield Diversion Dam	November	9.1	9.1	81.8
	December	13.6	4.6	81.8
	January	2.3	6.8	90.9
	February	0.0	2.3	97.7
	March	0.0	0.0	100.0
	April	0.0	0.0	100.0
	May	0.0	0.0	100.0
		< 150 cfs	150-250 cfs	> 250 cfs
Channel between Maxwell and Westland Diversion Dams	September[a]	25.0	50.0	25.0
	October	11.4	13.6	75.0
	November	15.9	9.1	75.0
	December	11.4	9.1	79.5
	January	6.8	6.8	86.4
	February	0.0	2.3	97.7
	March	0.0	0.0	100.0
	April	4.6	2.3	93.2
	May	2.3	4.6	93.2
	June	40.9	15.9	43.2

[a] Data for the second half of the month (September 16-30)

Table D4. Distribution of average monthly flows (expressed as percentage of years out of 44 years during 1935-78) during October-June for enhanced flows as provided by the CRP/Meacham Creek Storage Plan. Flow data was provided by the Bureau of Reclamation.

Obstruction	Month	< 100 cfs	100-150 cfs	> 150 cfs	< 200 cfs	200-300 cfs	> 300 cfs
Channel below Three Mile Falls Dam	September[a]	0.0	0.0	100.0	0.0	97.7	2.3
	October	0.0	4.6	95.4	9.1	34.1	56.8
	November	0.0	2.3	97.7	4.6	6.8	88.6
	December	0.0	6.8	93.2	11.4	11.4	77.2
	January	0.0	2.3	97.7	4.6	9.1	86.3
	February	0.0	2.3	97.7	2.3	4.6	93.1
	March	0.0	0.0	100.0	0.0	13.6	86.4
	April	2.3	2.3	95.4	6.8	6.8	86.4
	May	0.0	4.6	95.4	9.1	40.9	50.0
	June	2.3	6.8	90.9	15.9	65.9	18.2

Obstruction	Month	< 50 cfs	> 50 cfs	50-500 cfs	500-750 cfs	> 750 cfs
Three Mile Falls Dam	September[a]	0.0	100.0	100.0	0.0	0.0
	October	0.0	100.0	97.7	2.3	0.0
	November	0.0	100.0	77.3	18.2	4.5
	December	0.0	100.0	68.2	11.4	20.4
	January	0.0	100.0	56.8	13.6	29.6
	February	0.0	100.0	31.8	11.4	56.8
	March	0.0	100.0	25.0	13.6	61.4
	April	0.0	100.0	18.2	22.7	59.1
	May	0.0	100.0	54.5	15.9	29.6
	June	0.0	100.0	90.9	6.8	2.3

Obstruction	Month	< 100 cfs	100-150 cfs	> 150 cfs
Maxwell Diversion Dam	September[a]	0.0	0.0	100.0
	October	0.0	4.6	95.4
	November	2.3	4.6	93.1
	December	2.3	9.1	88.6
	January	2.3	2.3	95.4
	February	0.0	2.3	97.7
	March	0.0	0.0	100.0
	April	2.3	2.3	95.4
	May	0.0	0.0	100.0
	June	0.0	4.6	95.4

(continued nex page)

Table D4. (Continued)

Obstruction	Month	< 200 cfs	200-300 cfs	> 300 cfs
Westland Diversion Dam	September[a]	0.0	100.0	0.0
	October	9.1	29.5	61.4
	November	9.1	34.1	56.8
	December	18.2	45.5	36.3
	January	13.6	40.9	45.5
	February	2.3	25.0	72.7
	March	0.0	15.9	84.1
	April	6.8	0.0	93.2
	May	0.0	40.9	59.1
	June	9.1	68.2	22.7
		< 100 cfs	100-150 cfs	> 150 cfs
Cold Springs Diversion Dam	September[a]	0.0	0.0	100.0
	October	0.0	4.6	95.4
	November	4.6	2.3	93.1
	December	4.6	9.1	86.3
	January	2.3	6.8	90.9
	February	0.0	2.3	97.7
	March	0.0	0.0	100.0
	April	0.0	0.0	100.0
	May	0.0	0.0	100.0
	June	0.0	0.0	100.0
Stanfield Diversion Dam	Irrigation Dam Boards Up			
		< 200 cfs	200-300 cfs	> 300 cfs
	September[a]	0.0	61.4	38.6
	October	6.8	6.8	86.4
	June	0.0	4.6	95.4

(Continued next page)

Table 4

Obstr t

g B w

		< 100 cfs	100-150 cfs	> 150 cfs
Stanfield Diversion Dam	November	4.6	2.3	93.1
	December	6.8	6.8	86.4
	January	2.3	6.8	90.9
	February	0.0	2.3	97.7
	March	0.0	0.0	100.0
	April	0.0	0.0	100.0
	May	0.0	0.0	100.0
		< 150 cfs	150-250 cfs	> 250 cfs
Channel between Maxwell and Westland Diversion Dams	September[a]	0.0	50.0	50.0
	October	4.6	18.2	77.2
	November	6.8	20.5	72.7
	December	11.4	29.5	59.1
	January	6.8	59.1	34.1
	February	0.0	13.6	86.4
	March	0.0	6.8	93.2
	April	4.6	2.3	93.1
	May	0.0	20.5	79.5
	June	4.6	38.6	56.8

[a] Data for the second half of the month (September 16-30)

Table D5. Distribution of average monthly flows (expressed as percentage of years out of 44 years during 1935-78) during October-June for enhanced flows as provided by the McKay Storage Plan. Distribution of flows for September and November-June would be the same as the present flow condition with the McKay Storage Plan. Flow data was provided by the Bureau of Reclamation.

Obstruction						
	< 100 cfs	100-150 cfs	> 150 cfs	< 200 cfs	200-300 cfs	> 300 cfs
Channel below Three Mile Falls Dam	27.3	27.3	45.4	79.5	18.2	2.3
	< 50 cfs	> 50 cfs	50-500 cfs	500-750 cfs	> 750 cfs	
Three Mile Falls Dam	0	100.0	100.0	0.0	0.0	
	< 100 cfs	100-150 cfs	> 150 cfs			
Maxwell Diversion Dam	15.9	38.6	45.5			
	< 200 cfs	200-300 cfs	> 300 cfs			
Westland Diversion Dam	93.2	6.8	0.0			
	< 100 cfs	100-150 cfs	> 150 cfs			
Cold Springs Diversion Dam	0.0	61.4	38.6			
	< 200 cfs	200-300 cfs	> 300 cfs			
Stanfield Diversion Dam	88.6	4.6	6.8			
	< 150 cfs	150-200 cfs	> 200 cfs			
Channel between Maxwell and Westland Diversion Dams	54.5	38.6	6.8			

Table D6. Migration timing of anadromous salmonids in the Umatilla River.

	% By Month										
	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.
<u>Summer Steelhead</u>											
Adult[a]	--	1	8	16	18	21	21	12	3	--	--
Wild Smolt[b]	--	--	--	--	--	--	--	16	74	10	--
Hatchery Smolt[c]	--	--	--	--	--	--	--	50	50	--	--
<u>Fall Chinook</u>											
Adult[d]	15	(70)15	(15)70	(15)	--	--	--	--	--	--	
Wild Fingerling[e]	--	--	--	--	--	--	--	10	(60)10	(30)60	(30)
Hatchery Fingerling[f]	--	--	--	--	--	--	--	--	--	100	--
Hatchery Smolt[c]	--	--	--	--	--	--	--	50	50	--	--
<u>Spring Chinook</u>											
Adult[g]	--	--	--	--	--	--	--	20	50	30	--
Wild Smolt[h]	--	--	--	--	--	--	--	50	50	--	--
Hatchery Smolt[c]	--	--	--	--	--	--	--	50	50	--	--

a Average of 1966-67 to 1982-83 counts at Three Mile Falls Dam (Rm 3.0).

b Average of 1961, 1966, 1968, 1973, and 1977 counts at Westland Dam (Rm 77.3).

c April release date; migration times were estimated.

d Based on migration timing of adult fall chinook in the Yakima River during 1983 (Wasserman and Hubble 1983 and urnpublished data). Migration times under existing flows (in parenthesis) were shifted once month later to account for low flows in the Umatilla during October (see text for explanation).

e Based on migration timing of fall chinook subyearlings in the Yakima River during 1983 (Wasserman and Hubble 1983 and unpublished data). Migration times under existing flows (in parathesis) were shifted one month later to account for one month later spawning time estimated for the Umatilla (sect text for explanation).

f June release date; migration times were estimated.

g Based on migration timing of spring chinook over McNary Dam (1954-1981 average) (USACE 1981).

h Based on migration timing of spring chinook yearlings in the Yakima River during 1983 (Wasserman and Hubble 1903 and unpublished data).

Prior to channelization, biologists observed that the channel below Three Mile Falls Dam was a barrier to adults at flows less than 200 cfs. In this analysis, we assumed 200-300 cfs flows would limit passage to 80% without channel modifications. During late fall in 1984 when most of the proposed channel modifications were completed, a few adults were able to negotiate the lower channel at 100 cfs. In our analysis we assume a flow of 100 cfs will represent the minimum for passage following completion of the channel modifications. With channel work, we estimate flows of 100 to 150 cfs will limit passage to 80% and flows greater than 150 cfs will allow passage of all adults.

To account for instream passage problems adults will face above Three Mile Falls Dam (in addition to passage problems at diversion dams) under low flow conditions, we included in our analysis of upstream passage the category "Channel between Maxwell and Westland Diversion Dams" which refers to all channel obstructions in the 12.5 mile reach. As discussed earlier, flows are extremely low in this reach during fall and late spring months due to naturally low flows and numerous irrigation withdrawals. For the reach we estimated no passage of adults below 150 cfs, 80% passage at 150-250 cfs, and 100% passage at flows greater than 250 cfs. These criteria for passage were based in part on minimum stream flow recommendations by DEQ and the fish and wildlife agencies for the Umatilla below McKay Creek (Table 5). No passage improvements have been proposed for this reach.

Distributions of average monthly flows (expressed as percentage of years out of 44 years during 1935-78) during October-June for existing and McKay Storage Plan and September-June for CRP and CRP/Meacham Dam flows were determined for each obstruction (Tables 32 - 35). Flow data are provided for the second half of September (September 16-30) for CRP and CRP/Meacham Dam flows since we assumed earlier entry time of adults under enhanced flows.

We calculated percentage of adults passing each obstruction (Table 37) by the equation:

Σ [(% passage for each flow category)
x (flow distribution in month i)
x (% migrating in month i)]

For example, percentage passage of fall chinook in the channel below Three Mile Falls Dam with passage improvements under existing flows was calculated as follows:

1. From Table 31, the passage of adult fall chinook [expressed as percentage of fish passing) for the following flow categories was estimated:

c 100 cfs	100-150 cfs	> 150 cfs
0%	80%	100%

2. From Table D2, the distribution of average monthly flows for these flow categories was calculated:

	< 100 cfs	100-150 cfs	> 150 cfs
October	75.0	11.4	13.6
November	11.4	27.3	61.3
December	6.8	13.6	80.0

3. From Table D6, the percentage of fall chinook migrating by month is:

October - 15X November - 70% December - 15X

Table D7. Adult upstream passage conditions (expressed as percentage of fish surviving) at obstructions under existing and enhanced flows as provided by the Columbia River Pumping (CRP) Plan, the CRP/Meacham Dam Plan, and the McKay Storage Plan.

Obstruction	Without Passage Improvement												With Passage Improvement											
	Existing Flows			CRP Plan			CRP/Meacham Dam Plan			McKay Storage Plan			Existing Flows			CRP Plan			CRP/Meacham Dam Plan			McKay Storage Plan		
	StS	ChF	ChS	StS	ChF	ChS	StS	ChF	ChS	StS	ChF	ChS	StS	ChF	ChS	StS	ChF	ChS	StS	ChF	ChS	StS	ChF	ChS
Channel below Three Mile Falls Dam	88	32	56	96	83	87	96	85	90	88	34	56	96	75	73	99	99	96	99	100	98	96	82	73
Three Mile Falls Dam	85	81	52	86	94	74	86	95	74	85	88	52	96	85	67	97	100	97	97	100	100	96	93	67
Maxwell Diversion Dam	92	38	64	98	97	90	99	99	99	92	48	64	100	100	100	100	100	100	100	100	100	100	100	100
Cold Springs Diversion Dam	92	32	99	98	97	100	99	99	100	92	42	99	100	100	100	100	100	100	100	100	100	100	100	100
Westland Diversion Dam	85	21	59	93	61	73	94	84	88	85	21	59	100	100	100	100	100	100	100	100	100	100	100	100
Stanfield Diversion Dam	96	60	92	98	75	98	99	92	99	96	60	92	100	100	100	100	100	100	100	100	100	100	100	100
Stream Reach McKay Creek to Three Mile Falls Dam	88	25	62	97	82	84	98	91	93	88	30	62	(No passage improvements proposed)											

4. Using the equation given above, the passage each month was calculated:

October

Flow Category	% of flows x	Assumed passage(%) x	% migrating =	% passage
< 100 cfs	0.750	0.0	0.15	0.000
100-150 cfs	0.114	0.8	0.15	0.014
> 150 cfs	0.136	1.0	0.15	0.020
				0.034

November

Flow Category	% of flows x	Assumed passage(%) x	% migrating =	% passage
< 100 cfs	0.114	0.0	0.70	0.000
100-150 cfs	0.273	0.8	0.70	0.153
> 150 cfs	0.613	1.0	0.70	0.429
				0.582

December

Flow Category	% of flows x	Assumed passage(%) x	% migrating =	% passage
< 100 cfs	0.068	0.0	0.15	0.000
100-150 cfs	0.136	0.8	0.15	0.016
> 150 cfs	0.796	1.0	0.15	0.119
				0.135

5. Summing passages each month, the passage for the migration period is

$$0.034 + 0.582 + 0.135 = 0.751 \text{ or } 75.1\%$$

For both fall and spring chinook, we assumed that the percentage of fish surviving was equal to the percentage of fish passing. This was based on the assumption that any delay at obstructions would result in mortality. The timing of the upstream migration of fall chinook will be especially critical. We anticipate that the flows in the Umatilla during fall will not be adequate for entry of adults until November, shortly before adults need to reach spawning areas. Upstream migration timing of spring chinook will also be critical, since adults will need to reach holding pools in cool headwater areas before summer temperatures in the mainstem become excessive.

For summer steelhead, we assumed that only 50% of adults calculated as not passing would die. The percentage surviving was calculated with the equation:

$$\% \text{ Surviving} = \left[100 - \frac{(\% \text{ not passing})}{2} \right]$$

The lower mortality rate was based on the assumption that the timing of the upstream migration of summer steelhead is not as critical as fall and spring chinook. Summer steelhead can wait below an obstruction until flows become adequate for passage, since adults enter several months before spawning. Additionally, river temperatures are cool during the months when adults are migrating (October-May), and excessive temperatures are not a problem. Some mortality would occur from delay below the Three Mile Falls Dam.

Survival of adults over all upstream obstructions (Table D8) was calculated by multiplying passage conditions at each obstruction. For example, the survival of fall chinook over all obstructions under existing flows with only channel work completed (from data in Table D7) is 0.75 x 0.81 x 0.38 x 0.32 x 0.21 x 0.60 x 0.25 = 0.002 or 0.2%. With all passage improvements, survival is 0.75 x 0.85 x 1.00 x 1.00 x 1.00 x 1.00 x 0.25 = 0.159 or 15.9%. Note in Table D7 that even with passage of improvements in the channel below Three Mile and at the 5 diversion dams, upstream passage of chinook will still be limited in the channel between Maxwell and Westland Dams especially under present flows.

Table 08. Survival (X) of adults over all upstream obstructions.

	Without Passage Improvement a			With Passage Improvement		
	StS	ChF	ChS	StS	ChF	ChS
Existing Flows	49.6	0.2	8.1	81.1	15.9	30.3
CRP Plan	72.3	32.8	38.4	93.1	81.2	78.2
CRP/Meacham Dam Plan	75.3	65.4	58.2	94.1	91.0	91.1
McKay Storage Plan	49.6	0.5	8.1	81.1	22.9	30.3

a Assuming only the channel work below Three Mile Falls Dam has been completed.

The data in Table D8 suggest that without upstream passage improvements, few fall and spring chinook ((10%) and only about 50% of summer steelhead would survive over obstructions in the lower river under existing and McKay Storage Plan flows. Under CRP/Meacham Dam and CRP Plan flows, survival of all species would increase but remain less than 75%. With passage improvements, survival would exceed 75% for all species under CRP and CRP/Meacham Dam Plan flows. Under existing flows, survival would exceed 80% for summer steelhead and range between 15 and 30% for fall and spring chinook. Lower survivals for chinook would result from insufficient flows for passage in the channel between Maxwell and Westland Dams during all months of migration.

Downstream Passage Improvement

Fishery benefits of downstream passage improvement projects to naturally and hatchery produced salmonids were determined from juvenile downstream passage data at screened and unscreened diversions calculated with and without passage improvements. Passage of juveniles at screened diversions (Tables D9 and D10), expressed as percentage of fish surviving, were derived from mortality estimates of juveniles at each screen (Table D11), data on percentage of water sorted down each canal (Table D12), and migration timing for data of juveniles (Table 76).

Mortality at each screen was estimated for five types of passage problems:

1. Approach velocity exceeds criteria.
2. Screen mesh opening exceeds criteria.
3. Concrete piers of multi-drum systems are not flush with screens.
4. Screen is not angled to the bypass.
5. Bypass system is inadequate.

Table D9. Juvenile downstream passage conditions (expressed as percentage of fish surviving) of naturally produced salmonids at screens under existing and enhanced flows as provided by the Columbia River Pumping (CRP) Plan, the CRP/Meacham Dam Plan, and the McKay Storage Plan. Passage conditions assume no passage improvements. With passage improvements, passage is assumed 100% at each screen.

Screen	Existing Flows			CRP Plan			CRP/Meacham Dam Plan			McKay Storage Plan		
	sts	ChF	ChS	sts	ChF	ChS	sts	ChF	ChS	sts	ChF	ChS
Brownell	99	99	99	99	99	99	99	99	99	99	99	99
West Extension[a]	93	68	92	94	75	92	94	77	93	93	68	92
Maxwell	99	89	99	99	89	98	99	92	99	99	89	99
Dillon	99	96	99	99	94	99	99	97	99	99	96	99
Westland	94	45	93	94	45	93	95	57	93	94	45	93
Cold Springs	99	97	98	99	95	99	99	95	99	99	97	98
Stanfield	99	94	99	99	98	99	99	98	99	99	94	99
Survival over all screened diversions[b]	83.1	23.6	80.5	84.0	26.0	80.5	84.9	36.1	82.3	83.1	23.6	80.5

a Calculations were done using louver efficiency data from NMFS (1981) cited in FWS (1984).

b Calculated by multiplying survival rates at each diversion.

Table D10. Juvenile downstream passage conditions (expressed as percentage of fish surviving) of hatchery-produced salmonids at screens under existing and enhanced flows as provided by the Columbia River Pumping (CRP) Plan, the CRP/Meacham Dam Plan, and the McKay Storage Plan. Passage conditions assume no passage improvements. With passage improvements, passage is assumed 100% at each screen.

Screen	Existing Flows			CRP Plan			CRP/Meacham Dam Plan			McKay Storage Plan		
	StS 1+[a]	ChF 0+[b]	ChF & ChS 1+[a]	StS 1+[a]	ChF 0+[b]	ChF & ChS 1+[a]	StS 1+[a]	ChF 0+[b]	ChF & ChS 1+[a]	StS 1+[a]	ChF 0+[b]	ChF & ChS 1+[a]
Brownell	99	99	99	99	99	99	99	99	99	99	99	99
West Extension[c]	95	70	90	95	82	90	95	86	83	95	70	90
Maxwell	99	90	99	99	90	99	99	95	99	99	90	99
Dillon	99	98	99	99	98	99	99	98	99	99	98	99
Westland	96	47	93	96	47	93	96	65	95	96	47	93
Cold Springs	99	96	98	99	99	98	99	96	98	99	96	98
Stanfield	99	95	98	99	98	99	99	98	99	99	95	98
Survival over all[d] screened diversions	86.7	26.2	78.0	86.7	32.6	78.8	86.7	50.0	83.2	86.7	26.2	78.0

[a] Smolt (yearling) releases.

[b] Fingerling (subyearling) releases.

[c] Calculations were done using louver efficiency data from NMFS (1981) cited in FWS (1984). Since no data was available for fall chinook smolts, we used data for spring chinook smolts.

[d] Calculated by multiplying survival rates at each diversion.

Table D11. Estimated mortality of juvenile salmon and steelhead associated with passage problems at Umatilla screens.

		% Mortality								
		Steelhead Smolts			Fall Chinook Fingerlings				Fall and Spring Chinook Smolts-	
Type of Problem	Screens	Apr.	May	Jun.	Apr.	May	Jun.	Jul.	Apr.	May
1. Approach velocity exceeds criteria	Stanfield	0	5	5	5	5	5	5	0	5
	Cold Springs	0	0	0	5	5	0	0	0	0
	Westland	10	15	15	35	45	45	45	15	20
	Dillon	0	0	0	0	0	5	5	0	0
	Maxwell	5	5	5	5	5	5	5	5	5
2. Screen mesh opening exceeds criteria	Cold Springs				13	13	0	0		
	Westland				50	50	50	50		
	Maxwell				25	25	25	25		
3. Concrete piers of multi-drum systems are not flush with screens	Stanfield	2	2	2	10	10	10	10	4	4
	Cold Springs	4	4	4	20	20	20	0	8	a
	Westland	2	3	3	25	25	25	25	6	8
	Maxwell	1	1	1	5	5	5	5	2	2
4. Screen is not angled to the bypass	Standfield	1	1	1	5	5	5	5	2	2
	Cold Springs	1	1	1	5	5	5	0	2	2
	Westland	2	3	3	25	25	25	25	6	8
5. Bypass system is inadequate	Stanfield	1	1	1	5	5	5	5	2	2
	Cold Springs	1	1	1	5	5	5	5	2	2
	Westland	2	3	3	25	25	25	25	6	8
	Dillon	5	5	5	50	50	50	50	10	10
	Brownell	5	5	5	50	50	50	50	10	10
Total Mortality	Stanfield	4.0	8.8	8.8	22.8	22.8	22.8	22.8	7.8	12.5
	Cold Springs	5.9	5.9	5.9	40.3	40.3	27.8	0.0	11.6	11.6
	Westland	15.3	22.4	22.4	79.0	88.4	88.4	88.4	29.4	37.8
	Dillon	5.0	5.0	5.0	50.0	50.0	52.5	52.5	10.0	10.0
	Maxwell	6.0	6.0	6.0	32.3	32.3	32.3	32.3	6.9	6.9
	Brownell	5.0	5.0	5.0	50.0	50.0	50.0	50.0	10.0	10.0

Table 012. Diversions (cfs) in the Umatilla during April-July under present conditions compared to those that would occur due to operation of the CRP and CRP/Meacham Dam Plans (unpublished data from BR).

	April		May		June		July	
	Water Diverted	Water Remaining in River	Water Diverted	Water Remaining in River	Water Diverted	Water Remaining in River	Water Diverted	Water Remaining in River
Stanfield								
Present	90	1,547	118	962	121	381	124	250
CRP Plan	90	1,498	95	985	27	510	4	250
CRP/Meacham Dam Plan	90	1,498	95	985	27	510	4	250
Cold Springs								
Present	176	1,372	165	799	54	330	1	251
CRP Plan	208	1,292	159	828	7	506	0	260
CRP/Meacham Dam Plan	208	1,292	159	828	7	506	0	260
Westland [a]								
Present	186	1,190	210	599	206	134	211	50
CRP Plan	186	1,190	210	599	206	134	211	50
CRP/Meacham Dam Plan	203	1,092	213	625	206	310	211	59
Dillon								
Present	5	1,191	2	609	7	142	9	53
CRP Plan	5	1,191	2	609	7	142	9	53
CRP/Meacham Dam Plan	5	1,094	2	635	7	318	9	62
Maxwell								
Present	55	1,167	68	576	54	120	44	49
CRP Plan	55	1,167	68	576	54	120	44	49
CRP/Meacham Dam Plan	55	1,069	68	601	54	296	44	58
West Extension								
Present	156	1,095	168	548	164	108	166	23
CRP Plan	156	11049	159	583	104	255	166	26
CRP/Meacham Dam Plan	156	997	168	574	164	284	166	31

a Includes Allen Ditch.

Mortality due to excessive approach velocity was determined from velocity measurements made at each screen (Table 7) and impingement versus velocity data (Table D13). Impingement mortality of fall chinook fingerlings were based on swimming endurance and survival data of salmon and steelhead fry (Figures D1 and D2). The data indicate that impingement of salmon fry occurs at velocities as low as 0.6 ft/sec but significant impingement mortality does not occur until velocities exceed at least 1.5 ft/sec. Although survival data is given only for steelhead at 1.5 ft/sec in Figure D2, we assumed it would be similar for salmon. Impingement mortality of steelhead and fall and spring chinook smolts were based on swimming performance data of steelhead and salmon smolts (Brett 1967; Bell 1984).

Mortality due to pass-through of fall chinook fingerlings at Cold Springs, Westland, and Maxwell screens was determined from measurements of mesh openings and approach velocities (Table 7), impingement rate data (Figure D1) and data on mesh size requirements of juvenile salmon (Bell 1984). Bell's data suggests that 50% of the fal l chinook fingerlings would pass-through the 1/4” screen opening at Westland and about 25% would pass-through the 5/32"-3/16" screen openings at Cold Springs and Maxwell. We multiplied this pass-through rate by the impingement rate to estimate loss due to pass-through. Impingement mortality at Westland, Cold Springs, and Maxwell were adjusted to account for loss due to pass-through.

Mortality caused by the last three problems (3-5 above) were estimated by biologists of the fish and wildlife agencies since there were no mortality data available. We assumed that mortality caused by the piers of the multi-drum screens was dependent on approach velocity and number of piers. Mortality caused by the piers was estimated as follows:

Table 313. Assumed impingement mortality of juvenile salmon and steelhead at Umatilla screens with varying water velocities.

	% Mortality		
Velocity (ft/sec)	Steelhead	Fall Chinook	Spring Chinook
< 0.50	0	0	0
0.51-0.75	0	5	0
0.76-1.00	0	5	0
1.01-1.25	5	5	5
1.26-1.50	5	5	5
1.51-1.75	5	15	5
1.76-2.00	5	25	10
2.01-2.25	10	35	15
2.26-2.50	15	45	20

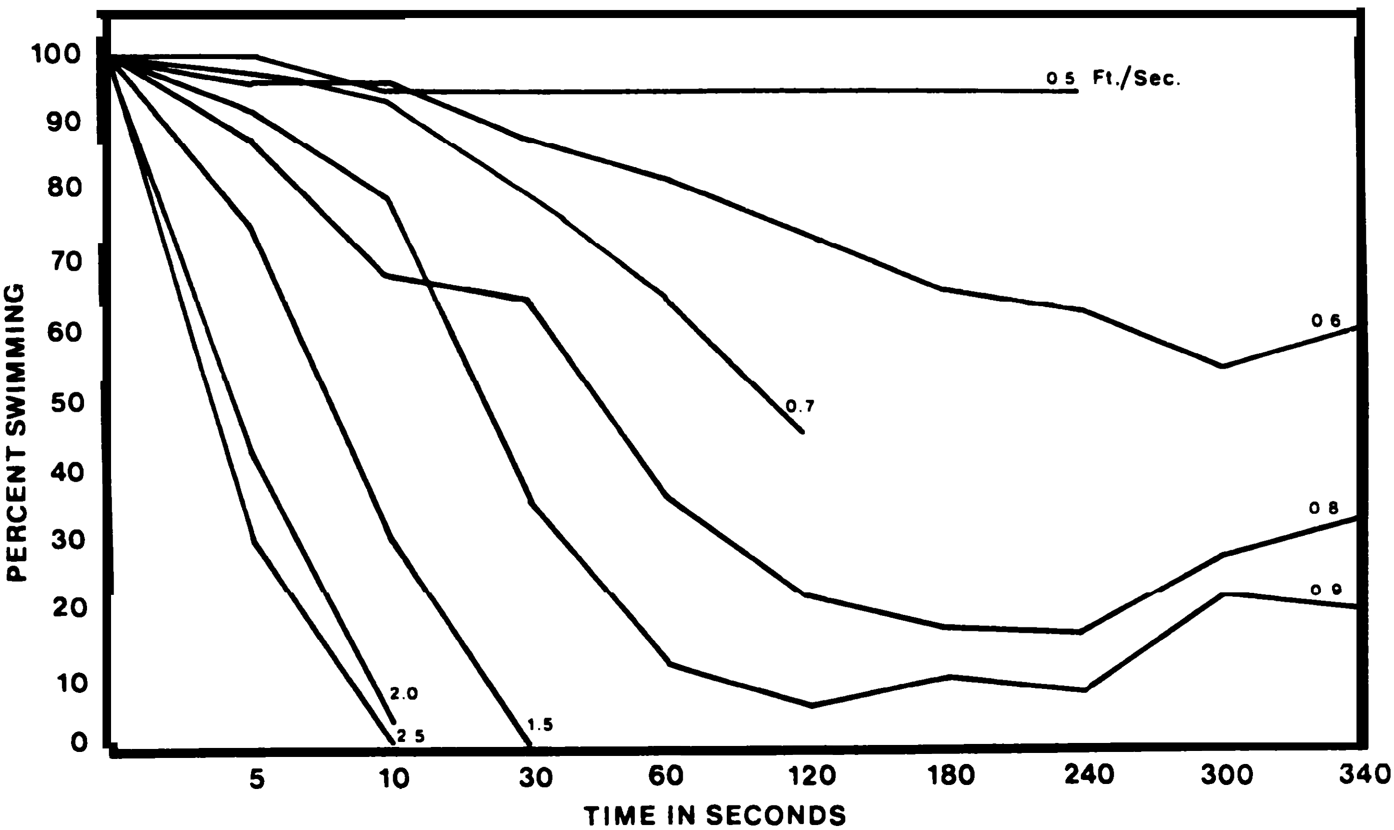

Figure D1. Swimming endurance of 39-mm chinook salmon (from Skinner 1974).

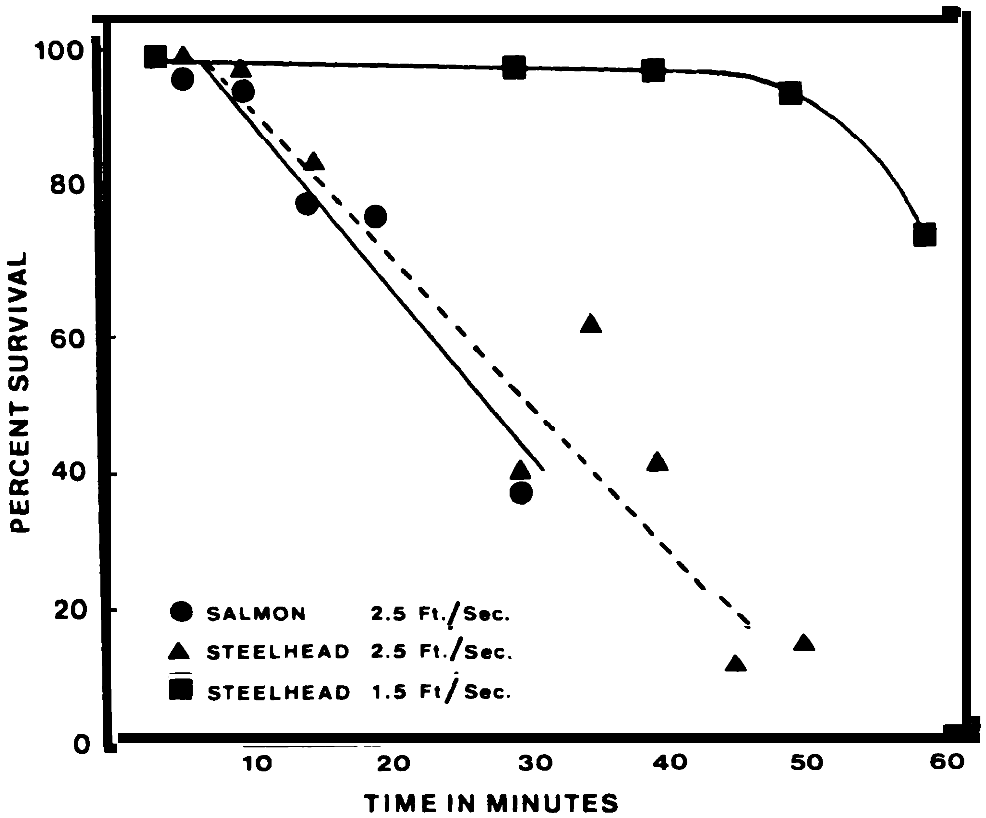

Figure D2. Survival of salmon (36 to 56-mm) and steelhead (22 to 36-mm) impinged for extended periods of time (lines fitted by eye) (from Skinner 1974).

Screen	Number of Piers	% Mortality: Steelhead Smolts	Fall Chinook Fingerlings	Fall and Spring Chinook Smolts
Westland, Maxwell	1	1	5	2
Stanfield	2	2	10	4
Cold Springs	4	4	20	a

Mortality was increased for each 0.25 ft/sec increment above the velocity that would cause >5% impingement mortality (Table 013). For example, the mortality of fall chinook fingerlings at Westland (1 pier) in May (approach velocity = 2.44 ft/sec) would be 5 x 5% = 25%.

Mortality caused by the screen not being angled to the bypass was assumed to be 1% for steelhead smolts, 2% for fall and spring chinook smolts, and 5% for fall chinook fingerlings. Mortality was increased for each 0.25 ft/sec increment above the velocity that would cause >5% impingement mortality.

Mortality at the port orifice bypass systems at Stanfield, Cold Springs, and Westland was assumed to be the same as mortality caused by the screen not angled to the bypass. It was assumed that the bypass systems at Dillon and Brownell would cause a 50% mortality to fall chinook fingerlings, a 10% mortality to fall and spring chinook and a 5% mortality to steelhead smolts. The gated bypass at Brownell is located 15 feet upstream from the screen. Since Dillon does not have a bypass, fish need to swim 15 feet upstream in the canal to reach the Umatilla.

Mortality at screens would be the same under each of the flows except at Stanfield. Mortality of juveniles at Stanfield during June would be significantly t-educed with the CRP and CRP/Meacham Dam Plans. Under each plan, the amount of water diverted would be reduced from 121 to 27 cfs in June and 124 to 4 cfs in July (Table D12) which would decrease approach velocities at the screen to < 0.30 ft/sec each month. Mortality of juveniles at this lower velocity would be negligible.

The survival of fish at each screen was calculated by multiplying survival rates (100 - % mortality) for the five types of passage problems. For example, the survival of wild fall chinook fingerlings at the Westland screen during May would be:

$$
\begin{array}{rl}
0.50 & \text{(survival after pass-through loss)} \\
\times\ 0.55 & \text{(survival after impingement mortality)} \\
\times\ 0.75 & \text{(survival after mortality due to obstruction by piers)} \\
\times\ 0.75 & \text{(survival after mortality due to poorly angled screen)} \\
\underline{\times\ 0.75} & \text{(survival after mortality due to inadequate bypass)} \\
= 0.116 \text{ or } 11.6\% &
\end{array}
$$

Downstream passage conditions (Tables D9 and D10) were calculated by the equation:

$$
\%\ \text{Surviving} = 100 - \left[\begin{array}{l} \Sigma\ [x\ (\%\ \text{migrating in month } i) \\ \quad x\ (\%\ \text{diverted into canal in month } i) \\ \quad\ (\%\ \text{mortality at screen in month } i)] \end{array} \right]
$$

Note in Table D9 that with improvements at screens, passage is assumed 100%. This assumption was made because a 100% bypass efficiency is our <u>goal</u> for screening facilities. However, because of variation in operation and maintenance of screens, bypass efficiencies may be less than 100% which would reduce fishery benefits from downstream passage improvements.

The percentage of fish diverted in the canals was assumed proportional to the percentage of water diverted (Table D12) since there was no available data to estimate actual numbers diverted. The percentage diverted will vary depending on several factors including the percentage of water diverted, turbidity, channel morphology, and structural characteristics of the diversion and intake. During periods of low flows when a relatively high percentage of water is diverted and the diversion is located on the channel side of the river, the percentage of fish diverted will be greater than the percentage of water diverted. Under these circumstances, survival of juveniles would be lower than those listed in Tables D9 and D10.

Passage of juveniles at unscreened diversions in the Umatilla River and Birch Creek (Tables 014 and D15), expressed as percentage of fish surviving, were derived from data on water diverted down each canal and migration timing data of juveniles (Table D6). There were no data on actual amount of water diverted at unscreened diversions, so we assumed it was equal to established water rights (Table D16). Flow data from the nearest USGS station in the Umatilla River or Birch Creek was used to compute the percentage of water diverted down the canals. We assumed that both hatchery and wild fish of all species would be lost in unscreened diversions on the main stem Umatilla (Table D14) but only wild summer steelhead would be lost in unscreened diversions on the main stem and East and West forks of Birch Creek (Table D15).

Table 014. Juvenile downstream passage conditions (expressed as percentage of fish surviving) of naturally and hatchery produced salmonids at unscreened diversions on the main stem Umatilla under existing flows. Passage conditions under the enhanced flows would be the same except as indicated.

	Natural Production			Hatchery Production			
	StS	ChF	ChS	StS	ChF 0+[a]	ChF 1+[b]	ChS
Wilson Ditch	99.9	98.8(99.4)[c]	99.9	99.9	98.9(99.3)[c]	99.9	99.9
Cunha Ditch	99.9	98.8(99.4)	99.9	99.9	98.9(99.3)	99.9	99.9
Brown's Dairy	99.9	99.5(99.6)	99.9	99.9	98.9(99.3)	99.9	99.9
Wyss Ditch	99.9	99.5(99.6)	99.9	99.9	99.2(99.3)	99.9	99.9
Crispin Ditch	99.9	99.8(99.9)	99.9	99.9	99.6(99.3)	99.9	99.9

a Fingerling releases.
b Smolt (yearling) releases.
c Passage under enhanced flows of the CRP and CRP/Meacham Dam Plans.

Table. D15. Juvenile downstream passage conditions (expressed as percentage of fish surviving) of naturally produced summer steelhead at unscreened diversions on the main stem, East Fork, and West Fork Birch Creek under existing flow. Passage conditions would be the same under the enhanced flows.

<u>Birch Creek</u>	
Johns, Smith, Beamer Canal	88.4
Kuhn Ditch	97.4
Straughan Ditch	97.4
Elridge and Hummel Ditch	95.2
Gambell Ditch	97.5
L.P. Ditch	96.0
<u>E. Fork Birch Creek</u>	
Sherrill Ditch	97.9
Cortazar Ditch	98.5
<u>W. Fork Birch Creek</u>	
Hutchinson Ditch	98.4
Cunningham Ditch	96.0

Table 316. Unscreened irrigation diversions in the Umatilla drainage.

Diversion	Location (Rm)	Water Right (cfs)
Umatilla River		
Wilson Ditch	29.0	3.76
Cunha Ditch	30.0	4.14
Brown's Dairy	47.0	4.01
Johns, Smith, Beamer Canal	48.8	Not Used
Wyss Ditch	50.8	2.46
Crispin Ditch	57.0	1.26
Birch Creek		
Johns, Smith, Beamer Canal	0.3	9.55
Kuhn Ditch	2.8	2.12
Straughan Ditch	4.8	2.03
Elridge and Humme 1 Ditch	10.2	4.82
Gambell Ditch	14.5	2.00
L. P. Ditch	16.0	3.33
E. Fork Birch Creek		
Sherrill Ditch	2.1	0.90
Cortazar Ditch	7.2	0.52
W. Fork Birch Creek		
Hutchinson Ditch	1.0	0.71
Cunningham Ditch	2.5	1.44

Passage of juveniles shown in Tables D14 and D15 was calculated with the equation:

$$\% \text{ Surviving} = 100 - \left[\Sigma \left[(\% \text{ migrating in month } i) \times (\% \text{ of fish diverted into canal in month } i) \right] \right]$$

Survival of juveniles over all diversions (Table D17) was calculated by multiplying survival rates at each screened and unscreened diversion. To calculate survivals we assumed 15% of the basin's wild steelhead population spawn and rear in Birch Creek.

Adult and Smolt Trucking

We also estimated benefits of trucking adults during their upstream migration (Table D18). Trucking of adults will be necessary without and with passage improvements. As previously discussed, even with passage improvements in the channel below Three Mile Falls Dam and at the 5 diversion dams, upstream passage of chinook will still be limited in channel areas between Maxwell and Westland Dams especially under present flow conditions. In this analysis we assumed 1) adults would be trucked from Three Mile Falls Dam to above Stanfield Diversion Dam, the last major dam on the main stem, 2) trucking would not be necessary for Sumner steelhead, since their upstream migration occurs primarily during late winter and early spring when there are no passage problems above Three Mile Falls Dam, and 3) the average percentage of fall and spring chinook that otherwise would not survive between Three Mile Falls and above Stanfield Diversion Dam (Line 3, Table D18) corresponds to the number that would be trucked (Line 4) under each of the flows. Survival data used are from Table D7. The percentage survival above Stanfield without and with

Table D17. Survival (%) of juveniles over all screened and unscreened diversions without passage improvements. Survival is assumed to be 100% with passage improvements.

	Existing Flows	CRP Plan	CRP/Meacham Dam Plan	McKay Storage Plan
Summer Steelhead				
Wild Smolt	78.7	79.6	80.4	78.7
Hatchery Smolt	86.3	86.3	86.3	86.3
Fall Chinook				
Wild Fingerling	22.8	25.5	35.3	22.8
Hatchery Fingerling	25.0	31.5	48.3	25.0
Hatchery Smolt	77.6	78.4	82.8	77.6
Spring Chinook				
Wild Smolt	80.1	81.8	80.1	80.1
Hatchery Smolt	77.6	78.4	82.8	77.6

Table D18. Calculation of fishery benefits of trucking adult fall and spring chinook. trucking.

	Existing Flows		CRP Plan		CRP/Meacham Dam Plan		McKay Storage Plan	
Without Upstream Passage Improvement[a]	ChF	ChS	ChF	ChS	ChF	ChS	ChF	ChS
1. % survival to Three Mile Falls Dam	60.8	38.0	93.1	71.0	95.0	72.5	72.2	38.0
2. % survival above Stanfield Diversion Dam without trucking	0.2	8.1	32.8	38.4	65.4	58.2	0.5	8.1
3. % mortality if not trucked (Line 1 minus Line 2)	60.6	29.9	60.3	32.6	29.6	14.3	71.7	29.9
4. % trucked	60.6	29.9	60.3	32.6	29.6	14.3	71.7	29.9
5. Trucking mortality (5% of Line 4)	3.0	1.5	3.0	1.6	1.5	0.7	3.6	1.5
6. % survival above Stanfield Diversion Dam with trucking (Line 4 minus Line 5 plus line 2)	57.8	36.5	90.1	69.4	93.5	71.8	68.6	36.5
With Upstream Passage Improvement								
1. % survival to Three Mile Falls Dam	63.8	48.9	99.0	93.1	100.0	98.0	76.3	48.9
2. % survival above Stanfield Diversion Dam without trucking	15.9	30.3	81.2	78.2	91.0	91.1	22.9	30.3
3. % mortality if not trucked (Line 1 minus Line 2)	47.9	18.6	17.8	14.9	9.0	6.9	53.4	18.6
4. % trucked	47.9	18.6	17.8	14.9	9.0	6.9	53.4	18.6
5. Trucking mortality (5% of Line 4)	2.4	0.9	0.9	0.7	0.5	0.3	2.7	0.9
6. % survival above Stanfield Diversion Dam with trucking (Line 4 minus Line 5 plus line 2)	61.4	48.0	98.1	92.4	99.5	97.7	73.6	48.0

[a] Assuming only channel work below the Three Mile Falls Dam has been completed.

trucking (lines 2 and 6, respectively) were used to calculate fishery benefits. We assumed a 5% trucking mortality of adults.

We also made survival estimates of juveniles in the lower stream channel with and without trucking (Table D19). We assumed at flows less than 15 cfs juveniles would be trapped at Westland and hauled to the Columbia River (as is currently done for steelhead under these flow conditions). The number of years between 1935 and 1978 when average monthly flows at the Umatilla Gage were less than 15 cfs provided our estimate of the percentage mortality of juveniles without trucking. We assumed the average percentage of juveniles that would be hauled under each of the flows would equal the percentage mortality without hauling. We estimated a 10% mortality of fall chinook fingerlings during trucking.

Habitat Improvement

Fishery benefits of habitat improvement projects in Meacham Creek to summer steelhead and spring chinook were calculated by NMFS (1984) using regressions of salmonid standing crop on Weighted Usable Area (WUA) for areas of degraded and natural riparian habitat in Eastern Oregon streams (see Summer Steelhead in Appendix C for the regressions and further explanation of the method). The IFIM model predicted a 3.0-fold increase in the number of summer steelhead and spring chinook smolts in Meacham Creek if proposed habitat projects were completed or a 1.8-fold increase in the basin's population assuming 40% of the population spawn and rear in Meacham Creek.

19. Juvenile downstream passage conditions (expressed as percent of fish surviving) in the stream channel in the lower Umatilla River with and without trucking.

	Existing Flows	CRP Plan	CRP/Meacham Dam Plan	McKay Storage Plan
Summer Steelhead				
Wild Smolt				
Without Trucking	86	100	100	86
With Trucking	100	100	100	100
Hatchery Smolt				
Without Trucking	90	100	100	90
With Trucking	100	100	100	100
Fall Chinook				
Wild Fingerling				
Without Trucking	70	100	100	70
With Trucking[a]	97	100	100	97
Hatchery Fingerling				
Without Trucking	73	100	100	73
With Trucking[a]	98	100	100	98
Hatchery Smolt				
Without Trucking	90	100	100	90
With Trucking	100	100	100	100
Spring Chinook				
Wild Smolt				
Without Trucking	90	100	100	90
With Trucking	100	100	100	100
Hatchery Smolt				
Without Trucking	90	100	100	90
With Trucking	100	100	100	100

[a] Assumes a 10% mortality of fingerlings trucked.

Production and Survival Rates Used to Calculate Fishery Benefits

The number of smolts produced per adult and smolt-to-adult survival rates used to calculate fishery benefits are listed in Table D20. Most of these data were discussed in Appendix C. The number of naturally produced smolts per adult fall chinook (210) was derived using fecundity (4,200 eggs/female) data of tipper run bright fall chinook at Bonneville Hatchery (ODFW unpublished data), and egg-to-smolt survival (15%) data of fall chinook in the Klamath River (Wales and Coots 1954). There were no available data on adults/redd for fall chinook so we assumed it was similar to spring chinook (3 adults/redd).

There were no data available to estimate smolt-to-adult survival for naturally produced fall chinook. We estimated this to be 0.5%.

Tie smolt-to-adult survival rate for naturally produced summer steelhead (4.0%) was estimated from Umatilla steelhead smolts captured at screens during 1973 and 1977. Adult survival rates were calculated using an average of adult counts at Three Mile Falls Dam 1 to 2 years later. Due to low flows, all smolts were trapped and transported downstream in 1973 and 1977. Smolt counts in these years represented the total population. To determine returns, we assumed a 20% l-salt and 80% 2-salt adult age composition based on analysis of scales from 32 wild adult steelhead trapped at Three Miles Falls Dam in 1983 (unpublished data, Raymond R. Boyce, Oregon Department of Fish and Wildlife, Portland, Oregon).

Table D20. Production and survival rates used in calculation of fishery benefits.

Natural Production	Smolts Per Adult	Source
Summer Steelhead	27	ODFW (1973 and 1982)
Fall Chinook	210	Wales and Coots (1954)
Spring Chinook	75	Knox et al. (1984) and Stainbrook (unpublished data)

Natural and Hatchery Production	Smolt-to-Adult Survival (%) [a]	
Summer Steelhead		
Natural Production	4.0	ODFW (1973 and 1983)
Hatchery Production	2.7	Olsen et al. (1984)
Fall Chinook		
Natural Production	0.5	Estimated
Hatchery Production		
Fingerlings	0.3	Hansen (1983 and unpublished data); Foster (unpublished data)
Smolts	0.5	Hansen (1983 and unpublished data)
Spring Chinook		
Natural Production	1.6	Lindsay et al. (1982)
Hatchery Production	0.6	Robart (unpublished data)

a Survival rates were adjusted to account for mortality of smolts and adults over Columbia River dams (smolts - 20%, adults - 15%) (Raymond 1979; Gibson et al. 1979).

We estimated a 1.6% smolt-to-adult survival rate for naturally produced spring chinook. This rate was based on 2.3% survival of 1975-79 brood spring chinooK in the Deschutes River (Lindsay et al. 1982) adjusted down 32% to account for mortality of smolts and adults over John Day Dam (Raymond 1979; Gibson et al. 1979).

Appendix E

Examples of Calculations of Fishery Benefits

To illustrate how fishery benefits were derived, we present two examples ("Adult and Smolt Trucking Only" and "All Projects Implemented") of calculations for both natural and hatchery production (Tables E-l and E-2). These examples illustrate most of the calculations we used to estimate fishery benefits for individual or combinations of projects. The examples are primarily self-explanatory; however, there are a few areas which need clarification.

1. Number of Adults Required for Maximum Smolt Production (Natural Production).

The calculation of natural production fishery benefits begins with the number of adults required for maximum smolt production. These numbers are listed in Table 21.

2. Number of Smolts Released (Hatchery Production).

The calculation of benefits to hatchery production begins with smolt releases required to achieve escapement goals. These smolt releases are listed in Table 23.

Table E1. Examples of computation of natural production fishery benefits.

Example 1 Adult and Smolt Trucking Only[a]	Existing Flows			CRP Plan		
	StS	ChF	ChS	StS	ChF	ChS
1. Number of Adults Required for Maximum Smolt Production	1,881	11,097	582	1,881	10,890	582
2. Number of Adults Surviving to Spawn						
Loss Due to Delay in Upstream Migration (25% for ChF)	--	-2,774	--	--	0	--
Upstream Passage Improvement	-948	-8,306	-535	-521	-7,318	-359
Adult Trucking (ChF and ChS)						
Loss if Not Trucked	--	(-5,044)[b]	(-174)[b]	--	(-6,577)[b]	(-190)[b]
Number Trucked	--	5,044	174	--	6,577	190
Trucking Mortality (5%)	--	-252	-9	--	-328	-10
	933	4,809	212	1,360	9,821	403
3. Number of Smolts Produced	25,191	1,009,890	15,900	36,720	2,062,410	30,225
4. Number of Smolts Surviving to Lower River						
Habitat Improvement (StS and ChS)	0	--	0	0	--	--
Downstream Passage Improvement	-5,366	-779,635	-3,164	-7,491	-1,536,495	-6,015
Smolt Trucking						
Loss if Not Trucked	-2,776	-69,076	-1,274	0	0	0
Number Trucked	2,776	69,076	1,274	0	0	0
Trucking Mortality (10% for ChF)	--	-6,908	--	0	0	--
	19,825	223,347	12,736	29,229	525,915	24,210
5. Adult Returns to Three Mile Falls Dam	793	1,117	204	1,169	2,630	387

	CRP/Meacham Dam			McKay Storage Plan		
1. Number of Adults Required for Maximum Smolt Production	2,859	11,403	1,166	1,881	11,907	582
2. Number of Adults Surviving to Spawn						
Loss Due to Delay in Upstream Migration (25% for ChF)	--	0	--	--	-2,774	--
Upstream Passage Improvement	-706	-3,945	-487	-948	-8,281	-535
Adult Trucking (ChF and ChS)						
Loss if Not Trucked	--	(-3,375)[b]	(-167)[b]	--	(-5,968)[b]	(-174)[b]
Number Trucked	--	3,375	167	--	5,968	174
Trucking Mortality (5%)	--	-169	-8	--	-298	-9
	2,153	10,664	838	933	5,712	212
3. Number of Smolts Produced	58,131	2,239,440	62,850	25,191	1,199,520	15,950
4. Number of Smolts Surviving to Lower River						
Habitat Improvement (StS and ChS)	0	--	--	0	--	0
Downstream Passage Improvement	-11,334	-1,448,918	-11,439	-5,366	-926,029	-3,164
Smolt Trucking						
Loss if Not Trucked	0	0	0	-2,776	-82,047	-1,274
Number Trucked	0	0	0	2,776	82,047	1,274
Trucking Mortality (10% for ChF)	--	0	--	--	-8,205	--
	46,737	790,522	51,411	19,825	265,286	12,736
5. Adult Returns to Three Mile Falls Dam	1,869	3,953	822	793	1,326	204

Table E1. (continued)

Example 2 All Projects Implemented (Ultimate)	Existing Flows			CRP Plan		
	StS	ChF	ChS	StS	ChF	ChS
1. Number of Adults Required for Maximum Smolt Production	1,881	11,097	582	1,881	10,890	582
2. Number of Adults Surviving to Spawn						
Loss Due to Delay in Upstream Migration (25% for ChF)	--	-2,774	--	--	0	--
Upstream Passage Improvement	-356	-7,000	-406	-130	-2,047	-127
Adult Trucking (ChF and ChS)						
Loss if Not Trucked	--	(-3,987)[b]	(-108)[b]	--	(-1,938)[b]	(-87)[b]
Number Trucked	--	3,987	108	--	1,938	87
Trucking Mortality (5%)	--	-199	-5	--	-96	-4
	1,525	5,110	279	1,751	10,683	538
3. Number of Smolts Produced	41,175	1,073,100	20,925	47,277	2,243,430	40,350
4. Number of Smolts Surviving to Lower River						
Habitat Improvement (StS and ChS)	32,940	--	16,740	37,822	--	32,280
Downstream Passage Improvement	0	0	0	0	0	0
Smolt Trucking						
Loss if Not Trucked	-10,376	-321,330	-1,674	0	0	0
Number Trucked	10,376	321,330	1,674	0	0	0
Trucking Mortality (10% for ChF)	--	- 32,133	--	--	0	--
	74,115	1,040,967	37,665	85,099	2,243,430	72,630
5. Adult Returns to Three Mile Falls Dam	2,965	5,204	603	3,404	11,217	1,162

	CRP/Meacham Dam			McKay Storage Plan		
	StS	ChF	ChS	StS	ChF	ChS
1. Number of Adults Required for Maximum Smolt Production	2,859	11,403	1,166	1,881	11,907	582
2. Number of Adults Surviving to Spawn						
Loss Due to Delay in Upstream Migration (25% for ChF)	--	0	--	--	-2,774	--
Upstream Passage Improvement	-169	-1,026	-103	-356	-6,417	-406
Adult Trucking (ChF and ChS)						
Loss if Not Trucked	--	(-1,026)[b]	(-80[b])	--	4,444	(-108)[b]
Number Trucked	--	1,026	80	--	4,444	108
Trucking Mortality (5%)	--	-51	-4	--	-222	-5
	2,690	11,352	1,139	1,525	6,128	279
3. Number of Smolts Produced	72,630	2,383,920	85,425	41,175	1,286,880	20,925
4. Number of Smolts Surviving to Lower River						
Habitat Improvement (StS and ChS)	58,104	--	68,340	32,940	--	16,740
Downstream Passage Improvement	0	0	0	0	0	0
Smolt Trucking						
Loss if Not Trucked	0	0	0	-10,376	-386,064	-1,674
Number Trucked	0	0	0	10,376	386,064	1,674
Trucking Mortality (10% for ChF)	--	0	--	--	-38,606	--
	130,734	2,383,920	153,765	74,115	1,248,274	37,665
5. Adult Returns to Three Mile Falls Dam	5,229	11,920	2,460	2,965	6,241	603

a Assuming passage improvement in the channel below Three Mile Dam has been made.
b Loss of adults between Three Mile Falls and Stanfield Diversion Dams. Parenthesis indicates this loss is included in the "Upstream Passage Improvement" category and is not an additional loss.

Table E2. Examples of computation of hatchery production fishery benefits.

	Existing Flows				CRP Plan			
	StS	ChF 1+[a]	ChF 0+[b]	ChS	StS	ChF 1+[a]	ChF 0+[b]	ChS
Example 1 Adult and Smolt Trucking Only[c]								
1. Number of Smolts Released	200,000	225,000	2,958,350	1,666,667	200,000	225,000	2,958,350	1,666,667
2. Number of Smolts Surviving to Lower River								
Downstream Passage Improvement	-27,400	-50,400	-2,218,763	-373,333	-27,400	-48,600	-2,026,469	-360,000
Smolt Trucking								
Loss if Not Trucked	-17,260	-17,460	-199,688	-129,333	0	0	0	0
Number Trucked	17,260	17,460	199,688	129,333	0	0	0	0
Trucking Mortality (10% for ChF 0+)	--	--	-19,969	--	--	--	0	--
	172,600	174,600	719,619	1,293,334	172,600	176,400	931,881	1,306,667
3. Number of Adults Produced	4,660	873	2,158	7,760	4,660	882	2,796	7,540
4. Number of Adults Surviving to Bonifer and Minthorn								
Loss Due to Delay in Migration (25% for ChF)	--	-218	-540	--	--	0	0	--
Upstream Passage Improvement	-2,349	-654	-1,615	-7,131	-1,291	-593	-1,879	-4,329
Adult Trucking (ChF and ChS)								
Loss if Not Trucked	--	(-397)[d]	(-980)[d]	(-2,320)[d]	--	(-532)[d]	(-1,686)[d]	(-2,556)[d]
Number Trucked	--	397	980	2,320	--	532	1,686	2,556
Trucking Mortality (5%)	--	-20	-49	-116	--	-27	-84	-128
	2,311	378	934	2,833	3,369	794	2,519	5,439
		Total ChF = 1,312				Total ChF = 3,313		

	CRP/Meacham Dam				McKay Storage Plan			
	StS	ChF 1+[a]	ChF 0+[b]	ChS	StS	ChF 1+[a]	ChF 0+[b]	ChS
1. Number of Smolts Released	200,000	225,000	2,958,350	1,666,667	200,000	225,000	2,958,350	1,666,667
2. Number of Smolts Surviving to Lower River								
Downstream Passage Improvement	-27,400	-38,700	-1,529,466	-286,667	-27,400	-50,400	-2,218,763	-373,333
Smolt Trucking								
Loss if Not Trucked	0	0	0	0	-17,260	-17,460	-199,688	-129,333
Number Trucked	0	0	0	0	17,260	17,460	199,688	129,333
Trucking Mortality (10% for ChF 0+)	--	--	0	--	--	--	-19,969	--
	172,600	186,300	1,428,884	1,380,000	172,600	174,600	719,619	1,293,334
3. Number of Adults Produced	4,660	932	4,287	8,280	4,660	873	2,158	7,760
4. Number of Adults Surviving to Bonifer and Minthorn								
Loss Due to Delay in Migration (25% for ChF)	--	0	0	--	--	-218	-540	--
Upstream Passage Improvement	-1,151	-322	-1,483	-3,461	-2,349	-652	-1,610	-7,131
Adult Trucking (ChF and ChS)								
Loss if Not Trucked	--	(-276)[d]	(-1,269)[d]	(-1,184)[d]	--	(-470)[d]	(-1,160)[d]	(-2,320)[d]
Number Trucked	--	276	1,269	1,184	--	470	1,160	2,320
Trucking Mortality (5%)	--	-14	-63	-59	--	-23	-58	-116
	3,509	872	4,010	5,944	2,311	450	1,110	2,333
		Total ChF = 4,882				Total ChF = 1,560		

Table E2. (continued)

	Existing Flows				CRP Plan			
	StS	ChF 1+a	ChF 0+b	ChS	StS	ChF 1+a	ChF 0+b	ChS
Example 2 All Projects Implemented (Ultimate)								
1. Number of Smolts Released	200,000	225,000	2,958,350	1,666,667	200,000	225,000	2,958,350	1,666,667
2. Number of Smolts Surviving to Lower River								
Downstream Passage Improvement	0	0	0	0	0	0	0	0
Smolt Trucking								
Loss if Not Trucked	-20,000	-22,500	-798,755	-166,667	0	0	0	0
Number Trucked	20,000	22,500	798,755	166,667	0	0	0	0
Trucking Mortality (10% for ChF 0+)	--	--	-79,876	--	--	--	0	--
	200,000	225,000	2,878,474	1,666,667	200,000	225,000	2,958,350	1,666,667
3. Number of Adults Produced	5,400	1,125	8,635	10,000	5,400	1,125	8,875	10,000
4. Number of Adults Surviving to Bonifer and Minthorn								
Loss Due to Delay in Migration (25% for ChF)	--	-281	-2,159	--	--	0	0	--
Upstream Passage Improvement	-1,021	-710	-5,446	-6,970	-373	-212	-1,669	-2,180
Adult Trucking (ChF and ChS)								
Loss if Not Trucked	--	(-404)d	(-3,102)d	(-1,360)d	--	(-200)d	(-1,580)d	(-1,490)d
Number Trucked	--	404	3,102	1,360	--	200	1,580	1,490
Trucking Mortality (5%)	--	-20	-155	-93	--	-10	-79	-75
	4,379	518	3,977	4,797	5,027	1,103	8,707	9,235
		Total ChF = 4,495				Total ChF = 9,810		

	CRP/Meacham Dam				McKay Storage Plan			
	StS	ChF 1+a	ChF 0+b	ChS	StS	ChF 1+a	ChF 0+b	ChS
1. Number of Smolts Released	200,000	225,000	2,958,350	1,666,667	200,000	225,000	2,958,350	1,666,667
2. Number of Smolts Surviving to Lower River								
Downstream Passage Improvement	0	0	0	0	0	0	0	0
Smolt Trucking								
Loss if Not Trucked	0	0	0	0	-20,000	-22,500	-798,755	-166,667
Number Trucked	0	0	0	0	20,000	22,500	798,755	166,667
Trucking Mortality (10% for ChF 0+)	--	--	0	--	--	--	-79,876	--
	200,000	225,000	2,958,350	1,666,667	200,000	225,000	2,878,474	1,666,667
3. Number of Adults Produced	5,400	1,125	8,875	10,000	5,400	1,125	8,635	10,000
4. Number of Adults Surviving to Bonifer and Minthorn								
Loss Due to Delay in Migration (25% for ChF)	--	0	0	--	--	-281	-2,159	--
Upstream Passage Improvement	-319	-101	-799	-890	-1,021	-651	-4,993	-6,97[illegible]
Adult Trucking (ChF and ChS)								
Loss if Not Trucked	--	(-101)d	(-799)d	(-690)d	--	(-451)d	(-3,458)d	(-1,36[illegible])d
Number Trucked	--	101	799	690	--	451	3,458	1,36[illegible]
Trucking Mortality (5%)	--	-5	-40	-35	--	-23	-173	-9[illegible]
	5,081	1,120	8,875	9,765	4,379	621	4,768	4,79[illegible]
		Total ChF = 9,955				Total ChF = 5,389		

a Smolt (yearling) releases.
b Fingerling (subyearling) releases.
c Assuming passage improvement in the channel below Three Mile Dam has been made.
d Loss of adults between Three Mile Falls and Stanfield Diversion Dams. Parenthesis indicates this loss is included in the "Upstream Passage Improvement" category and is not an additional loss.

3. <u>Upstream Passage Improvement</u>

Loss of adults listed under this category are losses over all upstream obstructions with and without passage improvements. Note that there is a loss of adults even if passage improvements are completed (as in both Examples 2) because survival of adults over all obstructions never reaches 100% (with the exception of fall chinook under CRP/Meacham Dam Plan flows) (Table D8).

4. <u>Adult and Smolt Trucking</u>

There are three items listed under Adult and Smolt Trucking (ChF and ChS):

- Loss if Not Trucked
- Number Trucked
- Trucking Mortality

For adult trucking, the loss is the number of adults that would not survive between Three Mile Falls Dam and above Stanfield Diversion Dam if not trucked. Survival data used in calculations appear in Table D18. In both examples for natural and hatchery production ("Adult and Smolt Trucking Only") the quantities in parentheses indicate that the losses of not hauling adults are accounted for in the Upstream Passage Improvement category and do not represent an additional loss. The number of adults trucked is assumed equal to the number lost if not trucked. We assumed A 5% mortality from hauling adults. In both Examples 2, note that we show no loss of adults. With upstream passage improvements, there would be no loss of adults between Three Mile Falls Dam and above Stanfield Diversion Dam. If adults can reach

Three Mile Falls Dam hauling is unnecessary because they can pass over all dams upstream.

For smolt trucking, the loss of smolts is the number of smolts that would not survive in the stream channel if not trucked. Survival data used in calculations are from Table D19. This quantity is in addition to losses in the Downstream Passage Improvement category, The number of smolts trucked is assumed to equal the number lost if not trucked. We assumed a 5% mortality of smolts during hauling.

5. Number of Smolts Produced.

From the number of adults surviving to spawn, the number of smolts produced per adult was calculated using data in Table D20.

6. Downstream Passage Improvement

Loss of smolts listed under this category are losses over all screened and unscreened diversions. Survival data used in these calculations are given in Table D17.

7. Adult Returns to Three Mile Falls Dam (Natural Production) and Number of Adults Produced (Hatchery Production).

Adult returns and adults produced were calculated using smolt to adult survival data in Table 020.

Appendix F

Agency Comments on the Rehabilitation Plan and ODFW Responses

Comments of cooperating (Confederated Tribes of the Umatilla Indian Reservation, Fish and Wildlife: Service, National Marine Fisheries Service, and Bureau of Reclamation) and non-cooperating (Pacific Northwest Utilities Conference Committee) (PNUCC)agencies on the June 1985 draft of the Rehabilitation Plan are attended. With few exceptions, we have incorporated all suggested changes of the cooperating agencies in the final draft of the Rehabilitation Plan. The major comments of the agencies and our responses are found below. The PNUCC's comments on the draft plan largely raise political objections and policy issues which are outside the scope of the plan. For this reason, we have addressed only those comments which deal with technical aspects of the report. Order of comments parallels the order of occurrence of subjects in the report .

CTUIR, FWS, NMFS, and BR Cements

Comment Need to mention that this effort supplements the 1984 Tribal/ODFW Umatilla Basin Salmon and Steelhead Restoration Plan. The previous plan basically accomplished Goals 1 and 3, while the present report adds more detail and updated information to these goals plus assigns fishery benefits to each project (Goal 2).

Response We agree. In the introduction, we acknowledge that the current plan supplements the 5-year Rehabilitation Plan developed by the Tribes and ODFW in 1984. Further, we state that the 5-year Plan identified fishery rehabilitation objectives (Goal 1) but did not provide a systematic evaluation of the potential fishery benefits if one or some combination of projects are implemented.

Comment There should be a clear statement in the plan on how BPA will use the final report to meet Goal 3.

Response We cannot speak for BPA. However, BPA has said it intends to submit the plan to the Council for endorsement prior to implementation of projects. Assuming endorsement, we believe that the report is sufficient for BPA to complete the planning phase and fully implement all projects identified in the plan.

Comment In light of the provisions of Section 4(h) of the Northwest Power Act, we recommend that projects be analyzed in a Columbia Basin context rather than one limited to the Umatilla Basin.

Response The provisions for project evaluation under the Power Act are unresolved at this time. For purposes of this report, benefits are in terms of adult returns to the Umatilla although we do provide catch-to-escapement ratios which could be used to calculate contribution to ocean and Columbia River fisheries.

Comment We do not believe trucking should be referred to as "rehabilitation". It could be termed "mitigation".

Response Technically, all projects including trucking could be termed "mitigation" because they are intended to lessen impacts of water and land uses in the Columbia Basin. We chose the word "rehabilitation" because it is broader in scope and describes our goal of the projects which is to restore productive runs of salmon and steelhead in the Umatilla.

Comment Need to specify that in this report that the CRP and CRP/Meacham Dam Plans refer to only the flow enhancement aspects of these projects. In the Bureau's Proposed Planning Report/Advanced Environmental Statement, these projects also include fish passage and habitat improvements and a post project evaluation study.

Response We made this distinction in the Glossary and in the Project Description section.

Comment Reference is made throughout the report to Table 2 of Section 704-d-1 in the NPPC Fish and Wildlife Program which is said to include a detailed listing of all habitat and passage projects for the Umatilla which have been included in the Fish and Wildlife Program. This is not true. Although all projects are theoretically included in the Fish and Wildlife Program, none of the specific habitat and passage items are identified in this table.

Response We concur, and deleted references which indicatea that projects are specifically identified in Table 2 of Section 704-d-l. In addition, in the introauction we state that although all fishery rehabilitation and flow enhancement projects are theoretically included in the Council's Fish and Wildlife Program, the identity, scope, and nature of habitat and passage related projects are unclear. Several projects are referred to by a single "dot" in Table 2 of Section 704-a-1. This report intends to provide the necessary detail for the Fish and Wildlife Program of all projects proposea for the Umatilla.

Comment We disagree that trucking fish will accrue benefits. Trucking would partially mitigate the adverse effects of flow depletion, but would not increase natural production of anadromous fish.

Response As discussed below, we emphasize that the main purpose of trucking is to restore passage in the basin until the flow enhancement projects are implemented. However, trucking would fulfill other purposes (provide passage during years of low flow, provide collection and transportation for hatchery supplementation/reintroduction projects, and increase management and research options) which would have to be done regardless if a flow project comes on line.

Comment The 1881 figure in Table 21 for steelhead under existing flows seems too low. A natural production rehabilitation objective should not be lower than the run sizes frequently observed in recent history.

Response The "natural production rehabilitation objectives" listed actually are production capabilities, i.e. adult spawners required for maximum smolt production. Typically, these number of adults are going to be less than the run sizes observed at Three Mile Falls Dam because of harvest above the dam. We used production capacities as our starting point in calculations of fishery benefits of naturally produced fish. Actually, we do not want to infer that the production capacities are our rehabilitation objectives because objectives are achievable only under the enhanced flows. To clear up this confusion, we have omitted all reference of production capacities as our fishery rehabilitation objectives.

Comment The discussion on increased number of adults produced in the basin from habitat improvement projects is confusing. Is this over and above improvements from Meacham Creek?

Response These are basinwide estimates including adults produced from habitat improvements in Meacham Creek. We used benefits estimated for Meacham Creek to project the basinwide figures.

Comment The discussion, or mention, of "surplus" fish for potential harvest in the Umatilla River is misleading based on comparisons of Tables 21 and 22. In only a very few cases do the estimated numbers of adult returns exceed the number required for maximum smolt production. In other words, rarely are the objectives achieved looking only at natural production potential.

Response This is correct. We elaborate on this and show what the surplus or deficit is for each species under each flow. The data shows that only under the Bureau's enhanced flows would natural production capacities for all species be achieved on a sustained basis and provide for in-river fisheries.

Comment The catch-to-escapement ratios given for fall and spring chinook look too high. Is there more recent data on fisheries for these species?

Response We have reduced catch/escapement ratios of fall and spring chinook to 3/1 and 1/1, respectively, based on recent ODFW data.

Comment Carson stock spring chinook are mentioned as the most likely candidate for introduction in the Umatilla Basin. Recent data on this stock at Spring Creek Hatchery indicates <0.1% may return as adults. Even a smaller percentage would return to the Umatilla. The 0.6% used in the report is probably overly optimistic.

Response Those were presmolt releases from Spring Creek. We assumed smolts would be released into the Umatilla which would have higher survival than the presmolts. There was no available survival data for Carson stock smolts released near the Umatilla so we used survival data for Deschutes stock smolts released from Warm Springs Hatchery (0.9%) and decreased this survival 32% to account for additional mortality over John Day Dam.

Comment The Bureau's flow enhancement projects should be given top priority in the proposed rehabilitation plan. The truck and haul program is not an acceptable substitute for a long term flow enhancement project, will fall short of meeting fishery and tribal needs in the basin and will not resolve water use conflicts.

Response We agree with this. The following changes were made.

1. In the Project Description section, we identified purposes of adult and smolt trapping/trucking projects which emphasizes that the main purpose of trucking is to restore passage in the basin until the flow enhancement projects are implemented. Trucking would fulfill other purposes (provide passage during years of low flow, provide collection and transportation for hatchery supplementation/reintroduction projects, and increase management and research options) which would have to be done regardless if the flow projects are implemented.

2. In the Proposed Rehabilitation Plan section, we have given the Bureau's flow enhancement projects top priority and provide the following justification for doing so:

   - Fishery escapement objectives for all species would be achieved on a substained basis.

Tribes treaty reserved right to salmon and steelhead would be achievea.

- Conflict involving stream flows between Indians and non-Indians would be substantially reduced, thus reducing risk of litigation.

- Options for Indian and non-Indian harvest and management in the lower Umatilla would be increased.

- Value of fall chinook entering the Umatilla would be increased.

- Need for trucking woula be reducea. The many logistic, operation, maintenance, and other problems of a large scale trucking project are discussed. Again, we state that a large scale trucking project would be used as an interim measure until the flow projects are implemented.

The "non-production" benefits attributable to flow enhancement mentioned above are also identified in text and tables in the Fisheries Benefit section.

Comment In Table 26 (hypothetical build-up rates for hatchery programs planned for the Umatilla) in the Rehabilitation Plan section, returns to the mouth of the Umatilla are shown. In Tables 23 and 24 in the Fishery Benefits section, hatchery returns are shown to the collection facilities. Please explain this inconsistency.

Response Returns to Bonifer and Minthorn were calculated to show fishery benefits of both upstream and downstream projects. However, under present and McKay Storage Plan flows, survival of adults to the facilities will be poor. Until greater flows are achieved and upstream passage improvements are completed, brood stock collection and harvest of hatchery adults will probably be done near the river mouth. For this reason and to simplify calculations, we showed hatchery returns to the river mouth to illustrate the build-up rates of hatchery programs.

Comment The plan should propose a release site for adult fish that are trucked upstream. Also, the potential for fall chinook spawning in the Umatilla downstream of Pendleton should be explored and estimated.

Response Planning is underway to develop detailed plans for production and harvest of Umatilla River salmonids. Release sites will be specified in those plans.

We estimated fall chinook spawning potential for stream reaches in the main stem above and below Pendleton (see Table C-2).

Comment We do not agree that Westland is the worst diversion dam for adult passage. Getting fish to migrate as far as and past Three Mile Falls Dam is the most severe passage problem at present.

Response We agree and this is why Three Mile Falls Dam upstream and downstream passage improvements received top priority. Westland is our next priority.

Comment Please explain where the estimate of 25% loss of fall chinook due to lack of flows came from. It may be just as appropriate to use 50 or 90%.

Response The estimate was derived by concensus opinion of representatives from all cooperating agencies. We acknowledge that losses could be much greater during years of low flow.

Comment Other factors, such as lack of adult holding water have prevented reestablishment of spring chinook. In addition to this list of assumptions for the spring chinook regression models, it is necessary to list factors that we know are limiting to spring chinook in the Umatilla Basin. We have to question why, if the potential production under existing flows is 582 adults, there are no spring chinook at all in the Umatilla River at present. The use of any model that predicts spring chinook use under present conditions must be questioned and ultimately either modified or rejected.

Response Factors which could limit production of spring chinook such as lack of summer holding pools are identified and discussed in the Factors Limiting Production section. Poaching may also be a serious problem.

NO Spring or fall chinook are present in the basin because runs were eliminated shortly after construction of Three Mile Falls Dam.

Comment It is agreed that fish passage modifications at the diversion dams could probably allow passage of adults at 50 cfs. However, due to shallow channel reaches, particularly between Maxwell and Westland Dams, chinook will need at least 150-250 cfs to provide for adequate upstream passage.

Response We agree, and included in our analysis of upstream passage (Appendix D) the condition that adults need >250 cfs for unobstructed upstream passage in channel areas between Maxwell and Westland Diversion Dams. Flow criteria used was based on or in part on minimum stream flow recommendations for the Umatilla below McKay Creek (Table 5). Our analysis indicates that even with passage improvements at the dams, upstream passage will be poor at channel areas between Maxwell and Westland Dams and a fairly large scale trucking program will be needed. Fishery benefits are about the same as before but to get those benefits adults will have to be trucked.

Comment It appears that the lack of flow in September was not taken into account in calculations of fishery benefits. Please explain the rationale for eliminating September from the analysis and elaborate on the implications of doing so i.e., this may translate into a net loss of productivity of fall chinook rather than a mere shift in migration and spawning time.

Response September flow is now used in calculations of fishery benefits but only under the Bureau's enhanced flow regimes (see next comment). Under present flow conditions, we estimated that 15% of adults would migrate in October, 70% in November, and 15% in December. Migration times are those of fall chinook in the Yakima River shifted one month forward to account for later migration times estimated for the Umatilla. Although peak numbers of chinook will arrive at the mouth of the Umatilla mid-September, adults will not be able to swim up the river until November after flows have increased. We feel that because of this delay, and because adults are forced to migrate shortly before they will spawn, there will be a loss in production (we estimated 25%). This loss will result from spawning before adults reach spawning areas of the Umatilla and increased pre-spawning mortality.

Comment Fall chinook migration timing would shift one month back with the Bureau's flow enhancement project starting with September. Need to point out in text that the "existing flows" migration timing is not the desirable condition and could cause egg incubation and juvenile development delays that could present downstream migration problems in July (lack of streamflows and high water temperatures).

Response We agree that with flows increasing about one month earlier during fall months, migration times would also shift one month earlier. Accordingly, we shifted peak migration times to October for adults and May for juveniles (similar to the Yakima River) and used these times in calculations of fishery benefits under the Bureau's flow projects (Appendix D). We used the same migration times (November peak for adults and June peak for juveniles) for existing and McKay Storage Plan flows. Because juveniles would be migrating later (until July) when flows are lower and temperatures are higher, we estimated that survival of smolts would be 30% lower under existing than enhanced flows.

Comment In Factors Limiting Production section, problems with existing screens were described. In Table D9 in Appendix D, however, bypass efficiencies up to 100% are attributed to various screens, among which Cold Springs is rated nearly perfect. We do not agree with these figures of over 95% for the average of these facilities. We also do not agree that 100% bypass is possible at any facility even with passage improvements. Given the present screen size, bypass location, and type and distance of most screens from the river, we recommend that all efficiencies be reduced.

Response Survival data in Table D9 is for the population after losses at screens was computed. Survival at screens is given in Table D11. We increased mortalities associated with concrete piers, angle of screens, and bypass system so that bypass efficiencies would be <100% including at Cold Springs. We are going to stick with the assumption that with passage improvements at screens bypass efficiencies would be 100% because this is our goal for screening facilities. We qualify this by stating that due to variation in operation and maintenance of screens, bypass efficiencies may be <100% at times.

Comment The assumption that the percentage of smolts diverted into irrigation canals is proportional to the percentage of water diverted is probably erroneous. Smolts are more likely to drift downstream along the bank margins than be evenly distributed in the water column. This would result in greater numbers entering the canals.

Response We had to assume this because we had no basis for determining percentages actually diverted. We qualify our assumption by saying that the percentage of juveniles diverted will vary depending on several factors including water diverted, turbidity, channel morphology, and characteristics of the diversion intake.

PNUCC Comments

Comment Steelhead juveniles were also released 1967-69 in the Umatilla, a total of 722,000 fish (Draft II, BPA Stock Assessment of Columbia River Anadromous Salmonids).

Response This is correct and these number of steelhead were added to Table 3. Releases of coho in the Umatilla during 1966-69 were also added to the table,

Comment If the 1984 and 1985 returns of fall chinook from earlier releases of hatchery fish... are poor, this would be an indication that the Umatilla is not good chinook habitat.

Response We disagree that returns from releases of hatchery fish is an indicator of condition of habit for naturally produced fish. We feel the Umatilla has vast potential for spawning and rearing of fall chinook although exact numbers will not be known for a few years after seeding capacities have been reached.

Comment We are somewhat surprised that hatchery coho are not the preferred species here. They would leave the stream in May... and adult timing of Washougal coho, for example, tends to be late, so low fall flow would be less critical.

Response Rehabilitation of coho in the Umatilla has been included in the Fish and Wildlife Program (Measure 704-d-1, Table 2). Although not specified in the current plan, we plan to begin reintroducing coho into the basin in the near future. Efforts are underway to develop detailed production plans for all species including coho.

Comment Several comments were made by PNUCC's technical advisor that fishery production and benefit estimates were based on "very tenous calculations without hard data".

Response We used the best available information and concensus opinion of the Tribes and fish and wildlife agencies to develop estimates which are consistent with provisions in the Power Act.

Comment There is no way to evaluate whether the habitat improvements are reasonable, or whether structural changes will be hydraulically permanent. Many are not, if not based on sound hydro-geomorphology and stream sense.

Response This is a general problem with habitat improvement throughout the Columbia Basin. We feel the proposed habitat improvements would provide substantial fishery benefits; however, there is no guarantee that those benefits will be realized.

Comment Annual maintenance costs of habitat projects (holding pools - $60 each; deflectors - $20 each; weirs - $20 each; and boulders-none) will be much greater.

Response These estimates were based on the best available information. Estimates will be revised when actual costs are available.

Comment The catch benefits of various flow enhancements will not equal annual costs.

Response We feel that fishery benefits would exceed annual costs without and with flow enhancement although a favorable benefit/cost ratio is not an issue since it is not required by the Power Act.

Comment Deschutes is of much better general quality than the Umatilla, for both incubation and rearing (comment about determining spawning potential of fall chinook in the Umatilla using Deschutes River data). But more important, were the gravel areas in the Deschutes measured with IFIM as they were in the Umatilla?

Response This estimate was used for comparative purposes, not for establishing production potential of fall chinook. We know of no study indicating that incubation and rearing conditions are better in the Deschutes than the Umatilla. Gravel estimates for both the Umatilla and Deschutes were from O DFW surveys not measured with IFIM.

Comment An evaluation of "food spawning gravel" in a stream as silted as the Umatilla ought to include sieving of samples to assess percentage of fines, estimates of permeability, and plants of "green" eggs in 20 or so gravel sites to assess survival. Predicting that 11,000 adults can use the Umatilla is risky business without these evaluations. IFIM uses a gravel surface "eyeball" determination that tells one nothing about intragravel conditions. Chinook are notoriously poor at distributing evenly, also. I think the numbers are too optimistic. Suspicion arises that over 10,000 falls cannot be accommodated in the Umatilla when one recalls that the escapement goal for upriver brights over McNary is only 40,000 adults.

Response There is no evidence to support the claim that siltation will limit production of fall chinook in the Umatilla. Spawning areas of fall chinook in the Umatilla are located in the upper watershed above agricultural lands (85% is located above Pendleton). Siltation is a problem in Alaska where spawning gravel can become "cemented" by coarse sediment but this is not a problem in Oregon streams. The finer sediment deposited on spawning beds in the Umatilla will not inhibit emergence of fry or cause significant reduction of oxygen to eggs. Spawning adults will also clean redds of this loose silt.

The escapement goal at McNary (40,000) is a management objective which has nothing to do with production potential above McNary. Incidentally, escapement of upriver brights over McNary last year was over 100,000. We feel the 10-11,000 naturally spawning fall chinook estimated for the Umatilla are realistic.

Comment Concerned about suitability of the drainage for spring chinook in regard to holding pools.

Response We also have this concern. We have proposed construction of several holding pools for adult spring chinook in the upper drainage. Even with these pools, the potential for sustaining natural populations of spring chinook is limited (we estimated production capabilities of 58201,166 adults, depending on flow) due to low late summer flows in the upper Umatilla. We feel these number of spring chinook are conservative.

Comment Doubt that hatchery spring chinook production can be 10,000 adults.

Response Achievement of our spring chinook objective (10,000 adults) is only limited by availability of funds for hatchery production.

GENERAL COUNCIL
and
BOARD of TRUSTEES

CONFEDERATED TRIBES

of the

Umatilla Indian Reservation

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October 4, 1385

John Palensky, Director
Division of Fish and Wildlife
Bonneville Power Administration
PO Box 3621
Portland, OR 97208

Attention: Thomas Vogel

Dear Mr. Palensky:

Following are comments of the Confederated Tribes of the Umatilla Indian Reservation on "A Comprehensive Plan for Rehabiliation of Anadromous Fish Stocks in the Umatilla River Basin".

We request that this letter- be appended to the plan verbatim and that the author give due weight to our limited suggested changes in the plan itself.

Below are general comments and conclusions. Appended are suggestions for specific changes in the document.

- In our view, the document underestimates the increase in anadromous fish possible under existing conditions. The long-delayed Umatilla Steelhead Hatchery, for example, would independently and significantly enhance tribal and non-tribal fisheries. Bonifer and Minthorn Springs Juvenile release/adult collection facilities in conjunction with yearling chinook from reprogrammed hatcheries also would contribute significant numbers of chinook salmon to tribal and non-tribal fisheries under existing conditions.

- The document tends to emphasize the natural production benefits of various rehabilitation measures. This emphasis is proper, but it should be made clear that even if 12 natural production benefits were possible, major hatchery releases would still be made in the Umatilla River Basin. As stated above, these releases are being made and will continue to be made under existing conditions. However, it is not feasible to obtain acceptable levels of hatchery adult returns without inplementing virtually all non-habitat measures presently in the Fish and Wildlife program.

As alluded to above, construction and operation of the Federal Columbia River Power System has for all practical purposes eliminated our Tribes' fishing opportunities in the John Day, Grande Ronde, Walla Walla, Tucannon, Imnaha, Powder, and Burnt River drainages. Tribal fishing is nonrecoverable in the latter two drainages, and it will be many more years before natural production in the remaining drainages will again support productive tribal fisheries. Once- productive main-stem Columbia River and Snake River tribal fishing sites were eliminated bY federal hydroelectric projects.

The Umatilla River Basin is the only practical place to quickly begin redressing the resulting adverse social, economic and cultural impacts on the people of the Confederated Tribes of the Umatilla Indian Reservation. Large releases of hatcher-y fish and the required passage, collection, and release facilities are the only practical near-term means of doing so.

o Not withstanding the above comments, the Confederated Tribes do not consider collection and hauling of adult and juvenile fish as a substitute for adequate instream flows and fish passage facilities.

Collection and hauling of adult and Juvenile fish will be critical to achieving minimal acceptable levels of product ion in the near term (lesser levels of hatchery returns can be achieved without collection and hauling).

Collection and hauling will still be useful - particularly but not exclusively during low water years - after an instream flow enhancement project is in place.

However even though collection and hauling theoretically could be employed to achieve the benefits projected in the report, it is our view that in practice the benefits would be significantly less than proJected. In our view, the logist its of 100% collection and hauling would severely constrain the timing, magnitude and, ultimately, the genetic composition of the runs. The number, quality, geographic and time distribution, and the social, economic, and cultural value of the fish would in practice be significantly less than implied by the numbers of fish theorized in the report.

Therefore, it should be emphasized that a salmon and steelhead restoration program principally dependent upon collection and hauling of fish over the long term would not satisfy the treaty obligation to the people of the Confederated Tribes.

- One of our principal criticisms of the document is the inaccurate and inadvertently misleading statement of the document's purpose. In the executive summary and introduction the report states the following objectives:

Objective 1: Establish fishery rehabilitation objectives for naturally and hatchery produced salmonids in the Umatilla Basin.

Objective 2: Estimate potential benefits of each rehabilitation and flow enhancement project to naturally and hatchery produced salmonids.

Objective 3: Develop a plan to set priorities, implement, and evaluate projects that will achieve rehabilitation objectives (Objective 1 above).

It should be clearly stated in the report (suggested language attached) that the Confederated Tribes and Oregon Department of Fish and Wildlife in 1983 jointly established fishery rehabilitation objectives for naturally and hatchery produced salmonids in the Umatilla Basin, set priorities and began implementation. The present report dutifully reproduces the previous plan's objectives and priorities.*

That leaves Objective 2 as the ostensible purpose of the planning document and the report should be modified to make this explicit.

The actual purpose of this planning document has always been unclear, to the preparing agency, the tribes and others. Comments on the draft reflect this fuzziness of purpose.

Indeed, at the September 24th interagency review meeting, the preparing agency, tribal and federal fishery agency representatives were surprised to learn from BPA that the report:

a) will be submitted to the Power Council and the public for approval before BPA funds additional projects in the Umatilla Basin (left ambiguous as to specifically which projects this applies to);

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* <u>The Umatilla River Basin: Recommended Salmon and Steelhead Habitat Improvement Measures.</u> Confederated Tribes of the Umatilla Indian Reservation. January 1984.

b) is designed to give BPA and others a rational approach for comparing Umatilla Basin Fish and Wildlife Program measures with other measures throughout the Columbia River Basin for funding.

The implications of these new "purposes" of a planning document ostensibly designed to estimate potential benefits of individual rehabi iation measures - surfaced at the eleventh hour - do not engender confidence in a process that has had the effect of delay in by several years implementation of high priority Fish and Wildlife Program measures in the Umatilla River Basin.

o With the caveats noted above, the report's analysis of benefits is generally well done given the inherent constraints. Nonetheless, when the potential, synergistic benefits of implementing a number of complexly interrelated measures are known - as is the case on the Umatilla River - we suggest that the region's ratepayers are best served by <u>measuring</u> the benefits after implementation rather than by pre-implementation estimates of marginal utility except - in this case - to delay implementation. In order for ratepayers to get proper credit for the proposed expenditures, they will have to pay for a second - post implementation - benefits analysis.

o The PNUCC's comments on the draft plan largely raise political objections and policy issues which are outside the scope of the draft plan are contrary to the salmon and steelhead restoration intent of Section 4(h) of the Pacific Northwest Power Planning and Conservation Act, and which will be vigorously contested by the Tribes in appropriate forums.

Nonetheless, the PNUCC has performed a service by stating explicitly objections commonly believed to have tacitly contributed to the years-long delay in implementing high priority Fish and Wildlife Program measures in the Umatilla Basin.

Comments of PNUCC's technical advisor are largely personal observations and opinions. We are perplexed by the observation that if 1984 and 1985 returns of fall chinook from earlier releases of <u>hatchery</u> fish "...are poor, this would be an indication that the Umatilla is not good chinook <u>habitat</u> [emphasis added]". In our view, this conclusion and the frequent reference to benefits equalling costs implies misunderstanding of our fall chinook restoration program and a very strained interpretation of the power act and treaty fishing rights vis a vis benefits and costs.

Despite the overall negative cast of Dr. Don Chapman's comments to PNUCC, he concludes:

"I have strong fear that the catch benefits of various flow enhancement measures will not equal annual costs. I think that making the best of existing flows with fishery enhancement and hatcheries may be the only reasonable alternative. If fall chinook (upriver brights) are to be a key race here, some purchase of McKay storage may be essential to get October flows high enough to pass or truck adults."

First, it is our view that the benefits of the proposed flow enhancement measures on the Umatilla River will substantially exceed costs. But that is not a prerequisite for implementing measures in the Fish and Wildlife Program or for complying with treaty rights. We would further argue it is proscribed as a criterion for either.

Second, no one presently is requesting ratepayer funding to construct a flow enhancement project for the Umatilla River. This project is proposed to be funded from the general treasury to comply with treaty fishing rights. This would constitute a $40 million cost-share. Ratepayer funding presently is anticipated for minor project elements such as purchasing uncontracted space in McKay Reservoir [F&W Program Reference: 704(b)15] and providing a small block of power for pumping.

Third, Dr. Chapman's conclusions confirm and reinforce the joint Tribal/ODFW plan and strategy to restore chinook and rehabilitate steelhead runs in the Umatilla River <u>with or without an instream flow enhancement project</u> (the without condition obviously yielding far less benefits). Hopefully, Dr. Chapman's conclusions will have more weight with BPA on this issue than tribal and ODFW assertions have had to date.

In his comments on the draft plan, BPA representative Gregory E. Drais states: "I would like to see a statement in the text that indicates the general nature of 704(d)(1) reference to the Umatilla (i.e., a series of dots in a table) and the probable need for Council review of specific activities and probable amendment of the Program to include this plan."

It is our understanding that council staff has informed BPA no such review or amendments are necessary. Taken at face value however, we could concur with the expressed need for additional details on projects 4 through 9 in table 24 <u>if</u> developed as part of project implementation and not used as the rationale for delay and/or "reapproval".

Given our experience to date, pending explicit definition of BPA intent and an evaluation of implications, the Confederated Tribes would object to any implied precedence that any measure already in the program must be "reapproved" in accordance with criteria unilaterally established by BPA.

Mr. Drais goes on to say, "I note that the schedule [in the draft plan] would have substantial work initiated in FY86. Given budget cycles, need for Council review and probable ammendment, and the need for greater levels of detail on projects, it is unlikely major efforts will be initiated until FY87 at the earliest."

In December 1983, BPA stated it would fund no fish and wildlife program measures in the Umatilla Basin until a "comprehensive plan" [analysis of individual measure's benefits] was produced. Upon completion of this plan [benefit analysis], in September 1985, BPA states "...it is unlikely major efforts will be initiated until FY87 at the earliest".

Mr. Drais infers that the proposed rehabilitation effort is "an all or nothing effort" requiring "input from decision makers...as a critical element to project initiation and, ultimately, completion".

The independent utility of each program measure in the Umatilla River Basin is clear in the draft plan and 1983 BPA-funded plan which it basically replicates except for apportionment of benefits among individual and groupings of proposed measures.

Mr. Drais questions a statement in the draft plan that the Northwest Power Council has given the Umatilla rehabilitation effort "top priority". We are not sure the council has ever formally stated those precise words, or why it would be necessary. The council approved a large number and variety of measures in the Umatilla Basin, perhaps more than any other tributary basin in the reach below McNary Dam. Included was construction and operation of the <u>only</u> full-cycle hatchery facility specifically exempted from the mixed stock fishery constraint and construction and operation of two juvenile release/adult collection facilities as well as the concept of reprograming which is integral to their operation.

Given the mandate of the act to give weight to recommendations of the states and tribes, it would seem reasonable to assume the council would reflect the fact that in 1980 - in anticipation of the Power Act - all state, federal and tribal salmon and steelhead entities in the

Columb.. River Basin gave the Umatilla and Yakima Rivers highest priority for rehabilitation of all streams in the Columbia River basin.**

It also seems reasonable to assume the council would reflect the fact that ODFW has given the Umatilla Basin highest priority in the state for enhancement under the Salmon and Steelhead Conservation and Enhancement Act. And the fact

that the Columbia Riv.r Fisheries Council consistently included Umatilla River Fish and Wildlife Program measures (including the years-long delayed Umatilla Steelhead Hatchery) among those it gave "highest priority" for implementation. And the fact that the Confederated Tribes give the Umatilla highest priority of all the tributary basins in northeastern Oregon and southwestern Washington where construction and operation of the Federal Columbia River Power System has been the principal factor in eliminating the tribal fishing opportunity protected by treaty.

In conclusion, we commend the author for a job well done given the lack of data, the virtual impossibility of accurately quantifying the benefits of individual measures which act in synergy, and the ill-defined plan objectives.

The draft plan [benefits analysis] clearly demonstrates, and the Pacific Northwest Utilities Conference Committee concurs, the feasibility and benefits to be derived from salmon and steelhead rehabilitation measures independent of the proposed instream flow enhancement project. Hopefully, this strawman will no longer be used as the rationale for further delaying funding of Fish and Wildlife Program measures.

No sound biological or technical rationale has been offered for delaving full implementation of these Fish and Wildlife Program meas.res. These measures are the most practical, cost-effective means of providing the Umatilla Tribes quick relief envisioned by Congress for the Federal Columbia River Power System's severe economic and social impact on tribal fisheries in the upper Columbia River Basin.

We are concerned about the redundant studies and apparently inexhaustible supply of procedural hurdles that in fact, if not intent, delay by years implementation of high priority Fish and Wildlife Program measures designed to deliver fish to long-deprived Indian people.

** <u>Columbia River Basin Salmon & Steelhead Management Framework Plan</u>, Columbia River Fisheries Council. March 1981.

The high priority Umatilla Steelhead Hatchery, for example, likely will not return the first fish to tribal fishermen for a decade or more after passage of the Northwest Power Act.

It seems appropriate to suggest this is unreasonable delay and contrary to the intent of the act which, according to the House Commerce Committee Report, was in response to a crisis that did not "...afford an opportunity for extensive studies, the acquisition of new data, or the development of the best available scientific knowledge [or, presumably, tenuous predictions of incremental benefits]".

The act requires use of the <u>best available information</u> and for giving heavy weight to recommendations of state and tribal fishery agencies. The Tribes and ODFW have gone to unprecedented lengths to develop the information required for intelligent

definition, prioritization and implementation of measures to rehabilitate the salmon and steelhead runs of the Umatilla River Basin (given highest priority - along with the Yakima - by all state, federal and tribal salmon and steelhead entities). Comparable information is not available for any other tributary of the Columbia River.

In passing the Pacific Northwest Electric Power Planning and Conservation Act, Congress called for bold steps to meet the Nation's treaty obligations to provide fish to Indian people. If the approach applied to the Umatilla River Basin by BPA were applied Columbia River Basin-wide, the entire Fish and Wildlife Program would virtually grind to a halt.

We are concerned there may not be sufficient sensitivity to the human consequences of the delay to date and of the additional delay likely to result from the latest ambiguous procedural hurdles advanced September 24th by BPA after review of the draft plan.

Each year of delay prolongs the adverse social, economic and cultural impact on the people of the Confederated Tribes, heightens the conflict between Indian and non-Indian fishermen, increases the likelihood of conflict between irrigation interests and treaty fishing rights and compounds the ultimate cost to the region's ratepayers.

We strongly urge the rapid completion of the subject plan [benefits analysis] with a minimum of wrangling over the marginally relevant details. In addition, we request that BPA provide the Confederated Tribes written, explicit details on:

> BPA's intended use of the completed plan;
>
> Which Fish and Wildlife Program measures BPA intends to delay funding pending "...review by the council and the public, ...greater levels of detail and ...amendment of the program";

Specifically what, if anything, BPA perceives as being required to init iate and complete each Umat illa River Basin project in the Fish and Wildlife Program and BPA's schedule for initiating and completing each measure.

The Confederated Tribes look forward to completion of the subject plan and timely implementat ion of all Umatilla Basin fisheries improvement projects.

Sincerely,

CONFEDERATED TRIBES OF THE
UMATILLA INDIAN RESERVATION

E 1 wood H. Patawa, Chariman
Board of Trustees

cc: Tribal Fish & Wildlife Committee
CRITFC - Wapato
ODFW - Boyce, Phelps, Kern
USF&WS - Garst
NMFS - Esch
NPPC - Nehlsen, Chrisman
BOR - Prange
PNUCC - Wright

SUGGESTED CHANGES FOR THE DRAFT REPORT:
A Comprehensive Plan for Rehabilitation of Anadromous Fish Stocks in the Umatilla River Basin

Page i. 1st Para Need to mention that this effort supplements the 1983 Tribal ODFW Umatilla Basin salmon and steelhead restoration plan. The previous plan basically accomplished objectives 1 and 3. This report adds more detail and updated information to these objectives plus assigns fish benefits to each project (Objective 2).

Page 1. 2nd Para The status of the Umatilla Basin fish restoration program is discussed as it existed two years ago. Not only are Umatilla Basin fisheries improvement projects included in the Fish and Wildlife Program, many are completed or ongoing. This type of introduction makes it sound like the Umatilla fisheries program is in a pre-implementation phase and that implementation might be contingent upon the subject report approval - this is not the case.

Page 13. 3rd Para Again, the discussion of fisheries operations in the basin is not current. Steelhead broodstock are spawned at the Bonifer Springs facility on the Umatilla Indian Reservation.

Page 79. Table 20. The 1881 figure for steelhead under existing flows seems low. A natural production rehabilitation objective should not be lower than the run sizes frequently observed in recent history.

Page 82. Table 21. Although we have no major problem with the methodology used and have no better substantiated figures, we feel it necessary to state that the natural production levels under no action seen significantly less than we would expect to occur.

Page 96. 4th Para. Trucking of adults is not the only reason for the fish trap to be installed at Three Mile Dam. Other benefits of a trap include expansion of fish research and management possibilities (tag fish, collect broodstock, check fish for various marks, etc.) as well as a potential terminal fishery site.

Page 143. Table D6. We do not take issue with the hypothetical migration times used for planning purposes in this table, however, the actual migration times of juveniles and adults will depend on several factors which are unknown at this time (flows, fish stocks, time & size of fish released, etc.).

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Division of Ecological Services
Portland Field Office
727 I. 1. 24th Avenue
Portland, Oregon 97232

Reference RG:mm

September 13, 1985

Mr. John Palensky, Director
Division of Fish and Wildlife
Bonneville Power Administration
P. 0. Boa 3621
Portland, Oregon 97208

Attn: Hr. Thomas Vogel

Dear Mr. Vogel:

The U.S. Fish and Wildlife Service (FWS) is pleased to provide its comments on the draft Umatilla River Comprehensive Plan. The plan, entitled "A Comprehensive Plan for Rehabilitation of Anadromous Fish Stocks in the Umatilla River Basin,. was prepared by the Oregon Department of Fish and wildlife (ODFW) for the Bonneville Power Administration EPA. It is our understanding that the comprehensive plan (plan) will be used by the BPA and Northwest Power Planning Council for implementation of fishery projecta In the Umatilla Barin.

The ODFW is to be complimented for the thorough, detailed, and coordinated effort they have made in preparing the draft report. The report provides a systematic approach for predicting how Umatilla River fisheries (present and future) will respond to a number of individual rehabilitation projects. Our comments can be separated into general and specific comments as listed below.

General Comments

Our main concern with the report is that it unintentionally misrepresents the importance of improved flows for restoration of anadromous fish to the Umatilla River Basin. The objectives for both existing and enhanced flows are nearly identical for all species - assuming the same habitat availability under both cases, and significant benefits are achieved under the existing flow conditions - largely because of a trucking program that would deal with flow problems. While we do not disagree with the potential for trucking to deal with flow shortages, it should definitely be considered a short-term solution to a long-term problem. The ultimate benefits of all rehabilitation projects cannot be realized until flow problems in the barin are resilved. The National Marine Fisheries Service (NMFS) provider a good summary of the problem with a trucking program in its letter of comment (Sept. 4, 1985) on the report. The FWS agrees with the findings of the NMFS letter.

On a separate but related matter, another general area of concern relates to the priorities and schedules for implementation of individual projects. Because of the importance of improved flown in realizing the full benefits to natural production, the flaw enhancement projects should be considered the top priority. Even the other rehabilitation projects (screening, habitat improvement, and passage improvement at diversion dams) are limited in their capability to achieve benefits without adequate flows. In other words, even the efficiency of screening and fish passage at existing barriers is limited, without adequate flows in the river. The capability of trapping and hauling to deal with this situation on a long-term baais is of concern (s~0 comment above). The flow problem is of particular concern for fall chinook and, to a lesser extent, for spring chinook.

A final area of general concern for the plan Is a detailed understanding of how it will be used in the dccision-making process by BPA. The report identifies an objective of the planning effort to be 'developing a plan to set priorities, implement, and evaluate rehabilitation projects, but says nothing about how BPA will accomplish this. In general, we feel the plan has been very conservative in its. estimates of benefits, and then has only presented them in terms of numbers of adult fish returning to the basin. Improved and restored runs of anadromous fish to the Umatilla River will also contribute to increases in the sport and commercial catch, as well as provide opportunity for fish to return to usual and accustomed place6 for fishing by the Confederated Tribes of the Umatilla Indian Reservation. Also, the specific amounts of water required for minimum and optima passage, and optimum rearing and spawning habitat, is not known. Nor is the optimum timing of the runs known, and yet these factors strongly Influence one another. Obviously, estimates as presented in the draft plan can only be predicted based on existing data. The best measure of success for arty measure will be experience. Therefore, the FWS believea that upon its finalization, the comprehensive plan should serve as an acceptable document to caplate the planning phase for BPA and major efforts should continue forward with implementation and evaluation of project&

Specific Comments

Page 2, paragraphs 2 and 3. There should b a clear statement in the plan on how BPA will use the final report to meet objective No. 3. Will the final report be a BPA product or will ft represent a report from the ODFW to BPA? As mentioned in the general comments, we have concern about how the report is used, particularly if it is for "selecting projects that have the greatest fishery benefits." Are there individual rehabilitation projects analyzed in the plan which are not being recommended for implementation?

Page 3, glossary of terms. We agree with the comments of NMFS that trapping/trucking [illegible]ically represents a short-term mitigation (lessening) measure than a long-term rehabilitation measure.

Page 3, glossar[illegible] [illegible]ural pr[illegible]uction objectives should not be described in terms of adult "[illegible]ry" returns.

Page 18, last paragraph. It is unclear why 150 cfs is suggested as a minimum required for passage in the lower (32 miles) of river. This figure is not consistent with flows recommended by FWS and NMFS in their reports to the Bureau of Reclamation (BR) for the flow enhancement project, and contradictory to flows presented in Table 5, page 20 of the plan.

Page 46, Flow Enhancement Projects. These projects are described and evaluated elsewhere throughout the report in terms of flow changes they would provide for the Umatilla River. However, in analyzing these BR projects under the Coordination Act, NMFS and FWS - based on input from the BR, also evaluated these projects for fish passage and screening improvements and habitat improvement. Any comparisons of the accomplishments of the "flow projects" should insure that all the same features are considered as part of the project. The opportunity to coordinate, and thus facilitate implementation of certain features of the BR project under the Fish and Wildlife Program, should be identified and discussed.

Page 65, Adult and Smolt Trapping/Trucking. Our concerns about trap and haul as a long-ternsolution have been presented earlier. We support the findings of NMFS in their September 4th letter on this matter.

Page 86, last paragraph. The discussion on increased numbers of adults produced in the basin from habitat improvement projects is confusing. Is this over and above improvements from Meacham Creek? Why don't the figures on top of page 87 agree with habitat improvement benefits as identified in Table 21?

Page 87, second paragraph. The discussion, or mention, of "surplus" fish for potential harvest in the Umatilla River is misleading based on comparisons of [illegible] and Table 21. In only a very few cases do the estimated numbers of adult returns exceed that number required for maximum smolt production. In other words, rarely are the objectives achieved looking only at natural production potential.

Page 94, Priorities and Schedules, and Table 24. We are concerned about the listing of priorities as discussed in this section. Based upon the need to improve flows for the long-term habitat-flow problems in the basin, and the ability of enhanced flows to improve the efficiency and functioning of other projects (i.e. screening, other passage improvements, and habitat improvements), the flow enhancement projects should at least equal the other projects in priority. Within the fishery rehab projects listing, improvement of conditions at Three Mile Dam should be first priority, with adult passage and screening improvements at the other major diversions closely behind. The logic behind the present, listed priorities should be explained.

Page 97, Table 25. The listing of hatchery "returns" for fall chinook for the years 1992 to 1995 should be listed as hatchery "releases."

Page 124, second paragraph. Although the location of gravels as presented in the report, based on the 1966 ODFW surveys, is accurate, there is no way of estimating specific spawning location at present, or under an individual flow enhancement project.

Page 152 and 153, Tables D9 and D10. The text identifies problems with existing screens earlier in the report, yet these tables seem to indicate a high percentage of fish surviving existing conditions. Bypass efficiencies seem too high and should be adjusted.

Page 161, first paragraph. The assumption that the percentage of fish diverted in the canals is proportional to the percent of water diverted is only accurate to the extent there is even distribution of fish across the channel. This assumption would grossly underestimate fish diverted if they were concentrated in certain areas of the stream channel, such as fall chinook tendencies to use the shallow shoreline areas during outmigration.

Page 164, Table D17 and Table D18. As mentioned earlier, this information can be misleading. The BR's flow enhancement projects have been analyzed only looking at the flow components of the projects, yet the BR's plans identify screening and adult passage improvements as part of the overall CRP and CRP/Meacham Plans.

In summary, we again compliment the ODFW on its efforts in undertaking the complexities of this comprehensive plan and completing the subject draft report. The FWS stands ready to assist in any way we can to complete the plan and move forward into the phase of project implementation and evaluation. Thank you for the opportunity to review the plan.

Sincerely,

Russell D. Peterson

Russell D. Peterson

cc:
ODFW, Boyce, Phelps, Fredd
NMFS, Eacn
CTUIR, Patawa, Farrow, James
FWS, Olney

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September 4, 1985 F/NWR5:690

Mr. John Palensky, Director
Division of Fish and Wildlife
Bonneville Power Administration
P. 0. Box 3621
Port1 and, Oregon 97208

Attention: Mr. Thomas Vogel

Dear ~~Mr. Palensky~~: John

National Marine Fisheries Service (NMFS) has reviewed the Umatilla River Basin Planning Report, "A Comprehensive Plan for Rehabilitation of Anadromous Fish Stocks in the Umatilla River Basin" (Plan), which was prepared by the Oregon Department of Fish and Wildlife (ODFW). The Plan was prepared for use by Bonneville Power Administration (BPA) and the Northwest Power Planning Council (NPPC) in selecting fishery restoration projects for funding in the Umatilla Basin. We have the following general and specific comments.

GENERAL COMMENTS

Our general comment on the Plan is that it incorrectly de-emphasizes the importance of improved flows for restoring anadromous fish in the Umatilla Giver Basin even though low stream flow is identified as the chief factor limiting production. A trucking program for both juvenile and adult salmon and steelhead is offered as an alternative long-term solution to chronic low flows and passage obstructions. We believe this alternative is not acceptable, however, for several reasons. First, and most important, it offers very little opportunity for long-term water conflict resolution in the Umatilla Basin. Second, trucking may not be feasible given the low flows in September, October, May and June that may prevent fall and spring chinook from migrating even as far as Three Mile Dam. This becomes apparent when flows less than a specified minimum are used for the purpose of analyzing the passage situation in the river channel downstream of Three Mile Dam. If we use 100 cfs as a minimum for adult fish passage (Table D1. page 135) this requirement is met only 2 percent of the time in the last half of September and 25 percent in October. Similar figures for May and June are 77 percent and 25 percent respectively. Even if we use 50 cfs as minimum, the requirement i met just 14 percent of the time in September, 45 percent in October, 79 percent in May and 29 percent in June. Therefore, we do not agree that the utility of trucking is as great as is represented in the report. Lastly, trucking the large numbers of fish projected in the Plan is unprecedented and may suffer from unforeseen problems. Trucking was originally discussed among fishery agencies and the Umatilla Tribe as a short-term, stop gap measure to enable the initiation of chinook brood stock development in the Umatilla Basin. We did not then, nor do we now recommend it as a long-term solution to flow and passage problems that have eliminated salmon and depressed steelhead runs in the Umatilla River for the past 75 years.

SPECIFIC COMMENTS

Executive Summary, Page II, 1st Para. Coho were also released in the Umatilla in the recent past, although the releases did not result in establishment of runs.

Page XI, 3rd Para. It is not clear if these are new fish or basin totals including present production.

Page 2, last Para. In light of the provisions of section 4(h) of the Northwest Power Act, we recommend that projects be analyzed in a Columbia Basin context rather than one limited to the Umatilla Basin.

Page 3, Glossary of Terms. We do not believe trucking should be referred to as "rehabilitation". It could be termed "mitigation".

Page 3, Glossary. Rehabilitation objective (natural production) refers to adult hatchery returns. This is confusing and should be rewritten by eliminating the word "hatchery".

Page 12, Table 2. This table could be improved by providing totals for each month of passage and then calculating the relative (percent) passage for each month along the lower margin of the table.

Page 18, Table 4. This table contains flow diversion data that could be summed by month, at the right margin. This would be more useful than totals taken by each canal. It is not clear what the units are at the bottom of the table - are they cfs or acre-feet?

Page 18, last Para. It should be explained why the Plan recommends a flow of 150 cfs when previous reports by NMFS, ODFW and Fish and Wildlife Service (FWS) recommended from 250 to 300 cfs for fish passage and production.

Page 19, 2nd Para. There are presently no spring chinook in the basin.

Page 10, Table 5. Flow recommendations made to the Bureau of Reclamation by the agencies and tribes should be included here or in a separate table. We will provide this information if necessary.

Page 29, 3rd Para. Change first sentence to read "Naturally and hatchery...."

Page 29, Fish Screening and Irrigation Diversions: Reference should be made, in this section of the Plan, to the 1985 ODFW report "Fish Screening in Northwest Oregon". On page 31 of the report, 5 open ditches in the Umatilla River basin are identified as the highest priority screen projects in the five river basin area which includes the Grande Ronde, John Day, Imnaha, and Umatilla Rivers.

Page 44, 2nd Para. ODFW, FWS and Umatilla Tribe recommended 150 cfs. Only NMFS recommended 200 cfs flow for the same bypass reach.

Page 45. A fourth item should be added to the list. Future streamflows, either from existing or new storage, could be diverted unless the FERC reserves them from use at the Boyd project by amending Mr. Boyd's license.

Page 52, Table 9. The need for flows to aid downstream migration in July has been identified, although a BR flow plan may not be able to provide them.

Page 62, 1st Para. The second sentence should have the following added to it on the end: "...as part of their Umatilla Basin Plan".

Page 62, list of criteria: In addition to an approach velocity (velocity normal to the screen surface) of 0.5 feet per second (fps), there should be a sweeping component along the face of the screen, toward the bypass, of at least twice the speed of water moving through the screen.

Page 65, 76 and others. Reference is made throughout this section of the report to table 704-d-1 in the NPPC Fish and Wildlife Program which is said to contain many detailed measures which have been theoretically accepted as amendments. None of the specific items are identified in that table. On a general reference to passage improvements in the Umatilla Basin is evident to us.

Page 67, 1st Para. Our previous discussions with the other fish agencies and the Umatilla Tribe, regarding trucking, have been predicated on the idea that trapping and hauling of fish would be a short term temporary situation. If BR cannot obtain Congressional authorization for their flow augmentation project, and the State of Oregon, Umatilla Tribe and the resource agencies do not wish to pursue flow augmentation through other legal and institutional means, then a trap and haul program would be the best option. We would not support a major capital expenditure for traps, holding ponds, etc. until all other avenues for obtaining flows are exhausted.

Page 70, 3rd Para. We are not aware of any reprogramming of Mitchell Act hatcheries to date. Discussions have taken place among fishery agencies and tribes but nothing definite has been resolved at this time.

Page 71, 1st Para. The contract negotiation for the 6,000 acre-feet of storage in McNary Reservoir should involve the BR in addition to the irrigation districts.

Page 77, 1st Para. We disagree that trucking fish will accrue benefits. Trucking would partially mitigate the adverse effects of flow depletion, but would not increase natural production of anadromous fish.

Page 81, 2nd and 3rd Para. Please explain why the fish numbers in the text do not agree with those in Table 20. Also, are the numbers expressed in terms of total run size or escapement?

Page 85, 1st Para. A third item should be added to the list of "non-production" benefits of improved flows:

3. Conflict resolution involving disputed stream flows would be greatly enhanced if the present flow situation was improved by a BR project.

Page 87. This discussion is confusing. The production estimate process should be elaborated upon. The catch to escapement ratio used for spring chinook seems high. Is there more recent data on the fishery for spring chinook?

Page 88, Table 22. On page 15 of the report, Carson stock spring chinook are mentioned as the most likely candidate for introduction in the Umatilla Basin. Recent data on this stock at Spring Creek Hatchery indicates that less than 0.1 percent may return as adults. Thus, to [illegible] adults, 10,000,000 juveniles would have to be liberated. Also, [illegible] are needed to account for loss at additional dams in the [illegible] River.

Page 92, 2nd Para. It is not clear if the Plan is dealing with hatchery or natural production in this paragraph.

Page 95, Table 24. It would appear that all items listed in this Table have the same priority based on their proposed sequencing in the schedule. What is the significance of the "+" and "0" symbols?

Page 96, 3rd Para. See our comment on Page 88 above.

Page 97, Table 25. Under the heading "Fall Chinook" the lines labeled "Hatchery Returns" should read "Hatchery releases". Elsewhere in the Plan it was stated that hatchery returns were counted at the upstream release facilities. This table is for returns to the mouth of the Umatilla. Please explain this inconsistency.

Page 99, 1st Para. The Plan should propose a release site for adult fish that are trucked upstream. Also the potential for fall chinook spawning in the Umatilla downstream of Pendleton should be explored and estimated.

Page 99, 2nd Para. We do not agree that Westland is the worst diversion dam for adult passage. Getting adult fish to migrate as far as and past Three Mile Dam is the most severe passage problem at present.

Page 100, 2nd Para. Under the heading "Small Diversions Passage Improvement" the Columbia River Fishery Development Program should be discussed as a potential source of construction and maintenance funding.

Page 222, Appendix A. Recommended optimum flows are available in the referenced 1973 ODFW Report and should be included here.

Page 123, 2nd Para. Reference is made to 1966 spawning surveys for fall chinook. Since no fall chinook have spawned in the Umatilla for many years, the 1966 survey must have been a gravel survey and should be so identified.

if it was a spawning survey, the species of fish spawning should be identified in the Plan.

Pace 124, 1st Para. The discussion on the location of gravels is generally co rrect. However, it does not follow that the fall chinook will all spawn above Pendleton. We have no logical basis for estimating spawning location at this time or where fish would spawn if a flow augmentation program is realized.

Page 126, 2nd Para. The second sentence should be changed to read "...in November determines potential production". Also, transportation flows for adults will be critical for their successful reproduction.

Page 127, 4th Para. The estimates could also imply that the 1966 gravel survey is overly optimistic.

Page 129, List. Other factors, such as lack of adult holding water have prevented reestablishment of spring chinook. In addition to this list of assumptions for the spring chinooks regression models, it is necessary to list factors that we know are limiting to spring chinook in the Umatilla Basin. We have to question why, if the potential proauction under existing flows is 582 adults, there are no spring chinook at all in the Umatilla River at present. The use of any model that predicts spring chinook use under present conditions must be questioned and ultimately either modified or rejected.

Page 131. See previous comments on spring chinook return rates.

Page 132, 3rd Para. Please explain where the estimate of number of adults required for maximum smolt production comes from.

Page 133, 1st Para. Please explain where the estimate of 25 percent loss due to lack of flows came from. It may be just as appropriate to use 50 or 90 percent.

Page 134, 1st Para. Please explain the derivation of the estimate that there would be 100 percent passage at flows greater than 50 cfs at Maxwell, Cold Springs, Westland and Stanfield diversion dams. By our estimation a flow of 50 cfs river the reach of Umatilla River from the mouth to Pendleton creates a severe passage condition.

Page 134, 2nd Para. Same comment as above. Also, there is a difference between "could pass" and "will pass" that boils down to semantics. "Could pass” seems to translate into the fact that the ladders will operate at these flows. "Will pass" means that behavioral and physical stimuli, needed to urge fish migration have been provided in addition to flows sufficient for operating the ladders.

Page 136, Table D2. Flows for September, which is traditionally the month of peak upper river bright fall chinook passage at nearby McNary Dam, should be included in the analysis.

Page 138, Table D3. Same comment as above.

Page 140, Table D4. Same comment as above.

Page 142, Table D5. It appears that the lack of flow in September was not taken into account in this process. Please explain the rational for eliminating September from the flow analysis and elaborate on the implications of doing so i.e., this may translate into a net loss of productivity rather than a mere shift in migration and spawning time.

Pages 148 and 143. This part of the report is somewhat misleading. The Bureau of Reclamation Umatilla Plan included passage improvements in addition to flows. In this report the passage improvement work has been segregated for the purpose of demonstrating its "separate utility". The flow and passage improvements must be considered essential for either flows or passage improvements to be completely successful.

Page 152, Table D9. On page 38, problems with existing screens were described. In this table, however, bypass efficiencies up to 100% are attributed to various screens, among which Cold Springs is rated nearly perfect. We do not agree with these figures of over 95% for the average of these facilities. We also do not agree that 100% bypass is possible at any facility even with passage improvements. Given the present screen size, bypass location and type and distance of most screens from the river, we recommend that all efficiencies be reduced.

Page 154, Table D11. See above comments.

Page 159 and 160. This text does not agree with information in Table D10 on Page 153. For example, the Table indicates that bypass and survival of fall chinook is 100 percent at Cold Springs diversion. -However, on page 159, it is stated that there is 20 percent mortality at Cold Springs due to the concrete piers alone.

Page 166, Table D18. We do not agree with the figures for adult survival in this table. In our report to BR on the Umatilla Basin, we estimated that with flow augmentation and a passage improvement plan, there would be very little delay and loss to adult fish. The table is very confusing also. For example, under CRP Plan, spring chinook are shown to have decreased survival with trucking. Are items 6, 5 and 2 added together to get survival to Three Mile? If so, the Table makes more sense, but needs to be rewritten to make it easier to understand. This is the case with many tables in the report. Often, we were confused by terminology to the extent that we could not review the material on the basis of its technical merits.

Thank you for the opportunity to review the Plan. Our major difficulty in accepting its conclusions and recommendations lies with the fact that if it is implemented, ultimate, long-term solution of the Umatilla Basin's flow problems may be permanently foregone. This clearly is not an option we wish to pursue at this time. It is our understanding that a meeting of Plan reviewers will convene on September 24, 1985 to discuss comments provided up to that time. We will be glad to elaborate or explain any of the above material at that meeting.

Sincerely yours,

R Evans

Dale R. Evans
Division Chief

cc: ODFW - Boyce, Fredd, Phelps, Lauman
USFWS, ES, Portland - Garst
CTUIR - Patawa, Farrow, James
CRITFC
NPPC - Chrisman

SEP 10 1985

PN 733
123.

John Palensky, Director
Division of Fish and Wildlife
Attention: Thomas Vogel
Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208

Dear Mr. Palensky:

Enclosed for your consideration are our comments on the June 1985 Comprehensive Plan for Rehabilitation of Anadromous Fish Stocks in the Umatilla River Basin.

As a cooperating agency in providing data to the Oregon Department of Fish and Wildlife (ODFW) for the report and our continuing role in Umatilla basin water project planning, we have considerable interest in the report. A number of the fishery enhancement measures identified in the report are included in our recommended development for the basin. The core element of our plan, as you know, is to increase streamflows in the Umatilla River to benefit anadromous fish runs through a water exchange program with irrigation districts. Bonneville Power Administration has recognized the value of the flow program, has endorsed the plan concept, and has indicated an intent to provide pumping power for the project to augment streamflows. Our proposal is far advanced, with field reviews of a preliminary report already completed and a formal planning report/draft environmental statement scheduled to be released for a 90-day public review later this year.

We believe the report is inadequate in its discussion of the need for and priority of implementing flow enhancement measures in the basin. During our water project planning effort, fishery interests have consistently emphasized flow shortages as the major factor inhibiting fish restoration in the Umatilla River. We believe this still to be the case. Yet, the report appears to portray a truck and haul program as an acceptable substitute for a flow enhancement program. We believe that the report reflects too favorably on an artificial hauling program, particularly in the case of chinook salmon. It is our feeling that a truck and haul effort will fall far short of meeting the basin's biological fishery needs and sport and Indian fish management program goals and will not defuse conflicts among fishery interests, the Umatilla tribes, and irrigation districts.

We believe there is merit in making expenditures under Fish and Wildlife Program authorities to fund the fishery rehabilitation projects discussed in the report, including an interim truck and haul program until a basin flow augmentation project is in place. However, the report is disappointingly weak in its recognition of streamflow improvement needs in the basin and the importance of flow augmentation in reaching a long-term solution to basin fishery problems. An artificial trapping and trucking program cannot fulfill tribal treaty rights nor provide the main means for getting chinook salmon to upriver spawning habitats. We strongly encourage you to consider modifying the report in regard to its treatment of flow enhancement measures.

Sincerely yours,

(Sgd) L. W. Lloyd

Regional Director

Enclosure

bcc: PN 730, 743, 150 (each w/enclosure)

RPrange:wfs 9/9/85

COMMENTS

1. Page vii, first full paragraph, lines 4 and 5.--Change to read: ". . . CRP Plan costs are estimated at $36,900,000 and $317,000[a/] for construction/capital and operation/maintenance, respectively, and $130,000,000 and $296,000 for construction/capital and operation/maintenance of CRP/Meacham Dam Plan. Both the CRP and CRP/Meacham Dam plans include costs for juvenile screening and adult passage improvements at Maxwell, Cold Springs, Westland, and Stanfield diversions and a 12-year postproject fishery monitoring study."

2. Page viii, top of table ii .--Change CRP and CRP/Meacham Dam plans' construction/capital costs and annual operation/maintenance costs per previous comment. Footnote these costs indicating they include juvenile screening and adult passage improvements at Maxwell, Westland, Cold Springs, and Stanfield diversions, plus funding for a 12 year postproject fishery monitoring study.

3. Page 1, last sentence .--Need to rephrase to read: "In addition to the CTUIR/ODFW plan, the Bureau of Reclamation has identified two plans to enhance flows in the basin for anadromous fish. The Recommended Plan (the Columbia River Pumping Plan) would allow water pumped from the Columbia River to be distributed to basin irrigation districts in exchange for McKay Reservoir storage plus natural flow rights that would be used for fish flow augmentation. The second plan alternative would combine a new headwater storage reservoir on the North Fork Meacham Creek with the Columbia River Pumping Plan to further increase basin fishery flows."

4. Page 5, CRP/Meacham Dam Plan, full name.--Delete "Creek" from Meacham Creek Dam Plan. This deletion should be made elsewhere in the report.

5. Page 9, top paragraph.--After "73,800 acre-feet capacity" add "(67,800 acre-feet active capacity)."

6. Page 18, last full sentence at page bottom.--We could find no further discussion in report that a minimum of 150 ft^3/s is needed for adult passage in the lower 32 miles of river. There is extensive coverage of fish passage flow needs at the diversion dams, but more discussion should be presented on potential channel restrictions between irrigation diversion dams under present flow conditions. We generally agree that flows of 150 ft^3/s are needed.

7. Page 19, first sentence, first full paragraph.--Should be revised to read: "If spring chinook were introduced, irrigation withdrawals during the spring months would often impede upstream migration and passage of adults under present conditions due to low streamflow conditions."

8. Page 28, second full paragraph, last sentence .--Add Westland and Stanfield -(diversion dams) and provide Fish and Wildlife Program reference number.

9. Page 43, Three Mile Falls Dam Project .--Other fisheries concerns related to this potential hydropower development include winter operation of fish screens in the West-Extension Irrigation District canal and potential false attraction flow problems at a powerplant tailrace.

10. Page 48, first full paragraph, second line.--Delete "and Maxwell" and make "Diversions" Singular.

11. Page 48, add the end of first full paragraph.--"The CRP Plan is presently the Bureau of Reclamation's Recommended Plan to enhance streamflow conditions in the Umatilla basin." The operation plan for the CRP Plan is illustrated in the enclosed table.

12. Page 52, table 9.--Replace with enclosed table showing revised operation plan for the CRP/Meacham Dam plan.

13. Page 56, line six.--Change the phrase "could be purchased" to "may be available for purchase."

14. Page 59, item 5.--The juvenile trapping station will be associated with the WEID canal fish screens not the west ladder. Adult trapping and counting facilities will be part of both ladders not just the west ladder.

15. Page 59, item 6.--The east ladder will be completely replaced (not corrected); the new 'ladder would incorporate a vertical slot design.

16. Page 59, item 8.--A juvenile sampling structure would be located between the bypass structure and the Umatilla River.

17. Page 63, first full paragraph, first two sentences.--Delete these sentences and replace with: "Bureau of Reclamation design estimates for the West Extension, Maxwell, Westland, Cold Springs, and Stanfield screens were based on meeting the above fish screening criteria."

18. Page 72, table 16.--Change annual operation/maintenance estimated costs for the CRP Plan to $317,000 and CRP/Meacham Dam Plan construction/capital costs to $130,000,000 and annual operation/maintenance costs to $296,000.

19. Pages 74 and 75, tables 17 and 18.--Change features description, footnotes, and cost estimates per the enclosed tables 17 and 18.

20. Page 85, bottom paragraph, fourth line.--Add the words "on average" after acre-feet.

21. Page 92, bottom paragraph.--Should say what number of adult fall and spring chinook and steelhead are needed to meet egg quotas for the Umatilla River hatchery production objectives.

22. Page 101, Flow Enhancements.--Throughout the report, there is relatively minor discussion devoted to the value, need for, and justification for flow enhancement. Based on the fishery problems discussion, lack of flows is a major constraint to establishment of healthy anadromous fisheries in the basin. Since ODFW has been a principal proponent of Reclamation's flow augmentation project, they should expand discussion of the need for increasing streamflows in the Umatilla River and the fishery values associated therewith.

23. Page 109, first citation.--Should be "Umatilla Basin Project, Proposed Planning Report/Advance Draft Environmental Statement."

24. Page 118, bottom paragraph, second sentence.--The increased number of smolts due to CRP/Meacham Dam Plan (22,044) does not include smolt production from riparian and instream habitat improvements which are also elements of this plan. Smolt production from these downstream habitat improvements needs to be included in the total.

25. Page 134, top paragraph, fourth sentence.--This sentence on fish passage at StanfIeld Diversion Dam IS confusing and needs to be rewritten.

26. Page 134, top paragraph, last sentence.--We agree that fish passage modifications at the diversion dams could probably allow passage at 50 ft^3 /s. However, due to shallow channel reaches, particularly from Westland Dam downstream, we believe adult fall chinook will need at least 100 ft^3/s-150 ft^3/s minimum to provide for adequate upstream migration. How would this assumption change fishery benefit calculations for the existing Umatilla River streamflow conditions?

27. Pages 136 and 137, table D2.--Should include flow statistics for the full month of September or the last half of September. Reclamation has provided data to ODFW.

28. Pages 138-141, tables D3 and D2.--Same as comment 27.

29. Page 143, table D6.--This table may be appropriate for fall chinook migration timing under existing flows, but it should also provide migration timing associated with the recommended flow enhancement project. We-believe fall chinook timing (percent by month) would shift 1 month forward, starting with September. Need to point out in text that the "existing flows" migration timing is not the desirable condition and could cause egg incubation and juvenile development delays that could present downstream migration problems later in July (lack of streamflows and high water temperatures).

30. Page 144, second paragraph, second line.--Change October-June to September-June.

31. Page 150, table D8.--Has the 25 percent mortality factor been accounted for in this table for fall chinook under existing flow conditions? If not, it should be.

32. Page 149, second full paragraph, next to last sentence.--Change 76.3 percent to 63.8 percent (based on table D8).

33. Page 161, top sentence.--The assumption that the percentage of smolts migrating downstream diverted into irrigation canals is proportional to the percentage of water diverted is probably erroneous. Smolts are more likely to drift downstream along the bank margins than be evenly distributed in the water column. This would result in greater numbers entering the canals.

Recommended Plan Anadromous Fishery Operation,
Main Stem Umatilla River
(Columbia River Pumping)

Month	Recommended Minimum Flows[1/] ft^3/s	Operational Procedures to Meet Recommended Minimum Flows
January	250	Flows provided by available natural flows plus Hermiston Irrigation District and County Line Improvement District diversion restrictions
February	250	
March	250	
April	250	
May	250	Flows provided through use of available natural flows plus Stanfield Irrigation District diversion restrictions. Fish migration to Three Mile Falls Diversion Dam during low flow periods improved by the use of the West Extension Irrigation District Pump.
June	250	
July	--	Minimum flows for anadromous fish not applicable
August	--	
September 1-15	--	
September 16-30	250	Flows provided by available natural flows plus McKay Reservoir storage releases
October	300	Flows provided by available natural flows, restrictions on Hermiston Irrigation District diversions and McKay Reservoir storage releases. Fish migration to Three Mile Falls Diversion Dam during low flow periods improved by the use of the West Extension Irrigation District pump.
November 1-15	300	
November 16-30	250	Flows provided by available natural flows plus Hermiston Irrigation District and County Line Improvement District diversion restrictions
December	250	

1/ Minimum flows for Umatilla River from the confluence of McKay Creek downstream

Alternative Plan Anadromous Fishery Operations
(Columbia River Pumping and Meacham Dam Storage)

Month	Recommended Minimum Flows 1/	Operational Procedures to Meet Recommended Minimum Flows
	ft^3/s	
Main Stem Umatilla River		
January	250	Flows provided by available natural flows plus Hermiston Irrigation District and County Line Improvement District diversion restrictions
February	250	
March	250	
April	250	
May	250	Flows provided through use of available natural flows which includes Stanfield Irrigation District diversion restrictions. Dry year flows improved with use of 3,600 acre-feet of Westland Irrigation District McKay storage
June	250	
July	--	Flows for anadromous fish not applicable
August	--	
September 1-15	--	
September 16-30	250	Flows provided by available natural flows plus McKay Reservoir storage releases
October	300	Flows provided by available natural flows, Hermiston Irrigation District diversion restrictions, plus storage releases prorated between McKay Reservoir and Meacham reservoir
November 1-15	300	
November 16-30 -	250	Flows provided by available natural flows plus Hermiston Irrigation District diversion restrictions and Meacham dam releases in dry years
December	250	
Meacham Creek		
July-October	40	Flows provided through available natural flows plus Meacham storage releases July through October
November-June	--	Minimum flows for anadromous fish not needed

1/ Minimum flows for (1) Umatilla River from the confluence of McKay Creek downstream and (2) Meacham Creek at its mouth

Table 17.--Summary of Costs of the Columbia River Pumping Plan (from BR 1985)

Capital/Construction Costs Feature	October 1983 Prices Total Costs
Total project cost	$37,000,000[a/]
Interest during construction	3,433,000[b/]
Project cost	$40,433,000
Less preauthorization costs	$ -202,000
Less historical and archeological salvage	-308,000
Net investment	$36,923,000

a/ Includes incremental cost for West Extension Irrigation District pump of $2,067,000

b/ Includes incremental cost associated with West Extension Irrigation District pump of $192,000

Annual Operation/Maintenance Costs Feature	October 1983 Prices Total Costs
Operation, maintenance, and replacements	$164,900
Wheeling (power)	152,200
Total	$316,900
Power	
Bonneville Power Administration contribution	$379,200[a/]
Increment to economic value	$531,900

a/ BPA contribution under the Fish and Wildlife Program

Table 18.--Summary of Costs of the Columbia River Pumping/Meacham Dam Plan (from BR 1985)

Capital/Construction Costs Feature	October 1983 Prices Total Costs
Meacham dam and reservoir	77,200,000
Columbia River pumping plant	13,000,000
Cold Springs Reservoir pumping plant	6,200,000
Stanfield relift pumping plant	1,950,000
Columbia-Cold Springs canal	5,500,000
Stanfield canal	1,600,000
Stanfield relift canal	2,000,000
Fish passage and protective facilities	3,100,000
Riparian zone enhancement facilities	440,000
Postconstruction evaluation program	500,000
Permanent operating facilities	70,000
Historical and archeological salvage	1,040,000
interest during construction	23,021,000
Project investment	135,621,000
Less investigation costs	-4,919,000
Less historical and archeological costs	-1,040,000
Net investment	129,662,000

Annual Operation/Maintenance Costs Feature	October 1983 Prices Total Costs
Pumping plants	167,600[a/]
Canals	5,000
Meacham dam and reservoir	21,000
Fish passage and protective facilities	63,000
Riparian zone enhancement	14,000
Hydromet facilities	15,000
Administration and general overhead	10,000
Total	295,600

a/ Includes 5102,500 for wheeling costs but does not include a cost for pumping power which would be provided by BPA at no cost

PNUCC

PACIFIC NORTHWEST UTILITIES CONFERENCE COMMITTEE

SEP 16 1985

September 13, 1985

John Palensky - PJ
Director, Division of Fish and Wildlife
Bonneville Power Administration
P.O. Box 3621
Portland, OR 97225

The Pacific Northwest Utilities Conference Committee (PNUCC) submits this letter in response to BPA's request for comments on the Comprehensive Plan for Rehabilitation of Anadromous Fish Stocks in the Umatilla River Basin. The PNUCC Fish and Wildlife Committee and our consultant, Dr. Don Chapman, have reviewed the plan. Dr. Chapman's written comments to PNUCC are attached to this letter. Based on these reviews, PNUCC opposes BPA proceeding with full implementation of this plan at this time based on the following concerns.

The level of production of steelhead, spring chinook, and fall chinook estimated in this plan cannot possibly be achieved until sufficient water flows are provided, particularly in the lower sections of the Umatilla River. PNUCC does not support BPA funding of additional fishery projects within the Umatilla Basin until the water resource problems within the basin have been solved. Further, PNUCC is seriously concerned about BPA involvement in water resources development and particularly opposes BPA funding of any water resource enhancment aspects of the Umatilla plan. PNUCC is developing an official policy statement on BPA involvement in water resources developmen? which will be submitted to BPA at a later date.

While PNUCC supported the use of off-site enhancement to address the fishery impacts of irrigation development in the Yakima Basin, our support was based on the following specific conditions: (1) the proposed activities were biologically sound; (2) equitable cost-sharing among interested parties was achieved; and (3) the Yakima was to be a "test case" for the enhancement provisions of the Northwest Power Act. PNUCC does not belie/e that these conditions can be satisfied in the Umatilla Basin because, as discussed above, there is insufficient available water and, based on Dr. Chapman's attached comments, we do not believe the habitat improvement measures will provide sufficient benefits to make the Umatilla Plan biologically sound. In addition, there is no indication of any attempt to achieve equitable cost-sharing, Further, PNUCC does not support any new major enhancement efforts until the Yakima test has Seen proven successful and a mechanism for crediting the use of BPA funds as off-site enhancement is established.

Any efforts to enhance the fishery in the Umatilla Basin prior to solution of the water problems should be concentrated in the lower river and limited to the artificial production and hatchery supplementation projects currently approved and funded by BPA under the Fish and Wildlife Program. Efforts to provide natural production of mainstern spawning fall chinook do not appear to be reasonable at this time. However, once adequate flows are supplied in the lower river, the feasibility of this aspect of the project might be reviewed. PNUCC suggests that any future feasibility study should include investigation of coho production as discussed on page 1 of Dr. Chapman's comments.

In conclusion, PNUCC does not support any BPA funding for further projects in the Umatilla B[illegible] until such time that the water resources problems are solved. However, BPA should encourage the parties in the Umatilla to resolve their water resources problems and should support and assist the Bureau of Reclamation in seeking the Congressional appropriations necessary for construction of the flow enhancement projects in the plan.

Sincerely,

Diana E. Snowden

Diana E. Snowden
Executive Director

PB:gh:142AA

Attachment

cc: Janis Chrisman, NW Power Planning Council

UMATILLA DRAFT REPORT

Detailed Comments of Dr. Don Chapman

P. ii: **"Summer steelhead have been released into the Umatilla since 1981 (up to 60,500 yearlings and 67,980 subyearlings have been released annually)."**

Steelhead juveniles were also released 1967-1969 in the Umatilla, a total of 722,000 fish (Draft II, BPA Stock Assessment of Col. R. Anadromous Salmonids).

P. ii: Paragraph 2 discusses past releases of fall chinook in the basin.

Since 3.54 million tules were planted in 1982, the first adults should have returned in 1984, and the majority will return in 1985. I think these recoveries will tell us whether juveniles can do well, and depart the Umatilla before summer high temperatures. Additionally, upriver bright fall yearlings that were released in 1983 should partially appear this fall. If returns in 1984 and 1985 are poor, this would be an indication that the Umatilla is not good chinook habitat. I am somewhat surprised that hatchery coho are not the preferred species here. They would leave the stream in May, would not be dependent upon freshwater summer rearing, and broodstock could be obtained easily at Three Mile trap. Even in extremely low-flow years, the hatchery fish would depart before critical conditions develop. Adult timing of Washougal coho, for example, tends to be late, so low fall flow would be less critical.

P. iii, Last Paragraph: "In the past, biologists have observed that the channel was a complete barrier to summer steelhead at flows less than 200 cfs."

I think that documentation of the last sentence is needed. I don't trust observations like this one.

P. iv, Paragraph 3: "Survival of hatchery and wild juveniles over all screened and unscreened diversions under existing flows is estimated to be 78.6-87.6 percent for summer steelhead, 22.2-80.6 percent for fall chinook, and 82.6 percent for spring chinook."

If one examines the underlying estimates on which this sentence is based, one finds very tenuous calculations without hard data.

P. 12: Last line " . . . because of low stream flows, adults would not be able to enter the river until November in most years. Spawning will likely occur in the main stem Umatilla during November and December. . . . juveniles will migrate to the ocean the following late spring and summer (May-July) . . ."

If upriver brights are used, their spawning will begin in mid-October, peak about November 12, and be over by November 25, based on Hanford Reach experience. The fry would emerge in mid-April to early May depending on incubation temperature. I expect that some would still be present as late as early July, but most would leave in June. I'd be concerned about temperatures.

P. 13: "Most steelhead adults resulting from the first large hatchery release (1982) will return during the winter of 1984/85 . . ."

Results from the 1982 steelhead smolt release are now available (see last paragraph). What were they?

P. 37, Paragraph 2: The FW'S (1984) felt that passage conditions at Three Mile Dam are probably on the low end of these ranges . . . The drop of fish over the dam or through the bypass may result in significant injury and mortality of juveniles."

Implies that a study of louver efficiency has been done at Three Mile. This is not true. The conjecture at the bottom of this paragraph is not supported by any observations or data.

P. 66: Table 15 lists habitat improvements proposed for the Umatilla Basin.

I have no way of evaluating whether the Umatilla tribal assessments of habitat improvements are reasonable, or whether structural changes will be hydraulically permanent. Many are not, if not based on sound hydro-geomorphology and stream sense.

P. 76: Table 19 lists costs for habitat improvement projects, including estimated annual maintenance for: holding pools - $60 each; deflectors - $20 each; weirs - $20 each; and boulders - none.

I think annual maintenance will be much greater than shown for holding pools, deflectors, weirs, and boulders.

P. 77: This page discusses in general terms the methods used to calculate fishery benefits.

It is important to compute benefits in monetary terms, so that benefits and costs can be compared. it is not satisfactory to argue that fishery benefits have considerable error associated with them, for this is equally true of the costs of fish enhancement and flow augmentation. Responsible fishery managers will want to know the B:C ratio. If a decision is made to proceed even if the B:C ratio is tractional (costs higher than benefits), it should be made with full awareness of income transfer.

P. 83: "As shown in Table D-18, even with upstream passage improvements, survival of fall chinook to Three Mile Falls Dam would be only 60.8 percent under existing flows. However, with enhanced flows of the CRP/Meacham Dam Plan, survival . . . would be 89.0 percent."

Percentage survivals shown in Table D- 18 are guesswork with tenuous bases. Incremental benefits associated with flow enhancement are stated as quantified but are based on very tenuous estimates. 1 am not criticizing an effort to quantify; merely pointing out the spongy character of the information.

P. 126: "Available data indicate that most fall chinook juveniles will migrate from the Umatilla prior to the low flow months of summer."

I do not expect fall chinook to be gone from the Umatilla by early July. Rearing flows may be important in June and July.

P. 126. Item 2: Spawning Potential of the Umatilla was estimated by the ratio:

$$\frac{\text{Spawning potential of ChF in Umatilla River}}{\text{Total ChF spawning area}} = \frac{\text{ChF spawners in Deschutes River}}{\text{Total ChF spawning area}}$$

Deschutes is of much better general quality than the Umatilla, for both incubation and rearing. But more important, were the gravel areas in the Deschutes measured with IFIM as they were in the Umatilla I doubt it, as Aney's work in 1967 was pre-IFIM.

P. 134: This page and Table D-l discusses adult upstream passage estimates for the main irrigation diversion dams.

This, and Table D-1, are guesswork without data.

P. 149: This page discusses the benefits to adult upstream passage of passage improvements and increased flows.

I suspect the cheapest form of improved passage for summer steelhead and chinook is trucking, and that the dollar benefits from water augmentation will not equal costs.

P. 154-160: These pages present the assumptions used to calculate downstream juvenile passage.

Based on some very gross assumptions.

P. 165-166: These pages discuss the estimates of adult and smolt trucking benefits.

Depends upon whether reasonable estimates of mortality at and below Three Mile Dam are made. No hard data are available.

Appendix C: This appendix presents the assumptions and calculations to estimate potential production of summer steelhead, fall chinook, spring chinook, and hatcheries.

Steelhead material on survivals look conservative and realistic in terms of production under existing conditions.

P. 124: This page discusses spawning gravel assumptions for fall chinook.

An evaluation of "good spawning gravel" in a stream as silted as the Umatilla ought to include sieving of samples to assess percentage of fines, estimates of permeability, and plants of "green" eggs in 23 or so gravel sites to assess survival. Predicting that 11,000 adults can use the Umatilla is risky business without these evaluations. IF111 uses a gravel surface "eyeball" determination that tells one nothing about intragravel conditions. Chinook are notoriously poor at distributing evenly, also. I think the numbers are too optimistic.

Perhaps ODFW has data that prove "good" gravel. If so, they should be added to Appendix C. Suspicion arises that over 10,000 falls cannot be accommodated in the Umatilla when one recalls that the escapement goal for upriver bright falls over McNary is only 40,000 fish. Is the Umatilla going to produce 25 percent as many fish as the Hanford Reach and Snake? Doesn't sound right to me.

General Notes

Water quality, especially suspended sediments, seem to be neglected in the draft. This is a stream subject to rain-on-snow events and intense rainstorms that move great amounts of silt. Mainstem spawning and rearing may or may not be marginal for fall chinook. One cannot tell from the data provided.

Fishery enhancement (p. vii in executive summary) costs $10 million plus annual O&M of $156,697. If we annualize the construction/capital across 30 years, we get roughly $1 million. Additionally, at $4.50 (includes capital and O&M) per pound for hatchery fish (about 192,933 pounds of fish, according to numbers in Table 22, page 88) one would spend about $870,000 per year on hatchery releases. Thus, total annual enhancement costs (natural and hatchery would be about $2.07 million. Annualized costs should be calculated addit ionally for flow enhancement.

What is finally needed is for the authors of the report to refine the annual amortized cost calculations for each incremental flow enhancement alternative and to calculate <u>catch</u> benefits (in dollars) that will result from these expenditures. Until this is done, it is impossible to estimate whether it is al! worthwhile or whether some incremental measure gives a positive benefit or not. If ratepayer representatives are to evaluate merits of various measures, this economic evaluation must be done.

I have some concerns with:

1. Suitability of the drainage for spring chinook in regard to holding pools.

2. The projected natural production of fall chinook looks too great for this drainage. Hatchery-supported fall stock may be feasible.

My answers to Pam Barrow's questions of August 6, 1985 are:

1. I have strong doubt that natural production will produce 11,000 fall chinook. I think the natural steelhead numbers are realistic. Spring chinook are very "iffy." I think hatchery production of falls and steelhead can be accomplished in the Umatilla Basin. I doubt that hatchery spring chinook production can be 10,000 fish.

   Question 1 requested an assessment of “whether the existing water in the Umatilla Basin can produce the numbers of fish (15,000> predicted by the plan.”

2. The incremental benefits provided by water flow enhancement are very “spongy,” based on almost no hard data.

   Question 2 asked “whether the incremental benefits provided by the various additional water sources are realistic.”

I have strong fear that the catch benefits of various flow enhancement measures will not equal annual costs. I think that making the best of existing flows with fishery enhancement and hatcheries may be the only reasonable alternative. If fall chinook (upriver brights) are to be a key race here, some purchase of McKay storage may be essential to get October flows high enough to pass or truck adults.

Bolded material inserted into Dr. Don Chapman’s comments of August 29, 1985.

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Bolded material inserted into Dr. Don Chapman's comments of August 20, 1985.